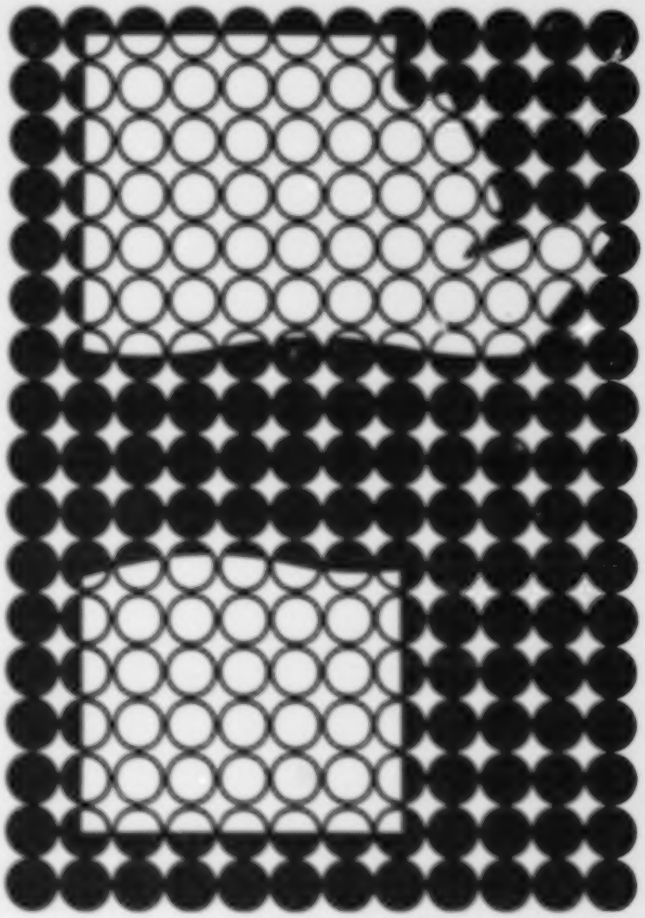

CANADA-MANITOBA
Soil Survey

Soils of the Rural Municipality of North Norfolk

Report D80

Government of Canada
Gouvernement du Canada

Government of Manitoba
Gouvernement du Manitoba

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SOILS REPORT NO. D80

1991

SOILS OF THE RURAL MUNICIPALITY OF NORTH NORFOLK

by

I. Greg Podolsky

CANADA-MANITOBA SOIL SURVEY

AGRICULTURE CANADA
MANITOBA DEPARTMENT OF AGRICULTURE
DEPARTMENT OF SOIL SCIENCE, UNIVERSITY OF MANITOBA

PREFACE

This interim report and maps of the detailed (1:20,000 scale) field and laboratory study of the soils of the Rural Municipality of North Norfolk is one in a series of such soil survey reports covering rural municipalities in southern Manitoba.

These reports reflect the growing concern by various government agencies that support the Canada-Manitoba Soil Survey, that a knowledge of the development and distribution of the soils of Manitoba is the key to understanding their properties, behaviour and response to management. This concern requires that soils be described both in terms of their basic properties and the nature of the environmental setting in which they are found. Thus, when areas such as the Rural Municipality of North Norfolk require delineation of land of high or low value for crop production or for other uses, the basic reference document is an accurate and reliable soil map.

The land resource information included in this resurvey covers approximately 115 503 ha of detailed survey which is only a small portion of the land area covered in the former reconnaissance (1:126,720 scale) survey of the Carberry Map Sheet Area, Report No. 7, (Ehrlich, Poyser, Pratt, 1957).

However, the projected more intensive use of the soils for agriculture and the growing competition for other uses of land in the area has created a need for more up-to-date, more accurate and more detailed soil information. The increased examination of soils in the field, the use of current aerial photography, the use of improved methods of studying soils in the laboratory and the accumulated knowledge of the properties and uses of soils over the years, have all contributed to the additional information contained in this new series of reports and maps.

During the course of the resurvey of the Rural Municipality of North Norfolk large volumes of site specific soil data were generated that for practical reasons cannot be included in this interim report. These data are currently being input into the Canada Soil Information System (CanSIS) data bank. This computerized system of data management permits automated manipulation and statistical evaluation of large volumes of data for soil characterization and interpretations. These data will shortly be available on request. In addition, the cartographic file of CanSIS provides a capability to produce derived maps of various kinds quickly and inexpensively. The types of derived maps that can be generated from the basic soil map include the sixteen interpretations that are provided in tabular form in this report as well as a number of single feature maps for such characteristics as drainage, texture of surface deposits, slope, stoniness and distribution of salinity. A package of interpretive maps and single feature derivative maps can be made available on request to: The Canada-Manitoba Soil Survey, Dept. of Soil Science, Rm. 362, Ellis Bldg., University of Manitoba, Winnipeg, Man. R3T 2N2, 474-7114; 474-6118.

The Canada-Manitoba Soil Survey trusts that this report and accompanying map will be of value to all individuals and agencies involved with the use of land within the map area.

ACKNOWLEDGEMENTS

This soils study was conducted as a joint project of the Canada Department of Agriculture, Manitoba Department of Agriculture and the Soil Science Department of the University of Manitoba.

The soils were mapped by:L. Hopkins, M. Langman, E. St. Jacques and D. Swidinsky.

Field assistants involved in the mapping were N. Mazur, D. Thomlinson, T. Adshead and D. Potter.

Laboratory analysis were provided by R. Mirza, K.C. Yeung and J. Madden under the direction of P. Haluschak.

Cartographic Services

Mapping bases provided by the Land Resource Research Institute, Ottawa.

Map compilation and digitization in preparation for publication and addition to the CanSIS cartographic file provided by J. Griffiths, R. DePape and M. Brown.

Manuscript review and soil correlation were provided by M. N. Langman, W. Michalyna, G. F. Mills and R. E. Smith.

Computer processing and programming provided by C. Aglugub.

Final typing and word processing of report provided by D. Sandberg.

HOW TO USE THIS SOIL REPORT

This soils report contains considerable information about the soils, their origin and formation, their classification and their potential for various uses such as dryland agriculture, irrigation, engineering and recreation. The report is divided into four parts: Part I provides a general description of the area; Part 2 describes the methodology used in the study; Part 3 discusses the development, scientific classification and morphological characteristics of the soils in the study area, and Part 4 provides an interpretation of soil properties and associated landscape features as they affect soil capability or suitability for various uses.

The soil map of the study area is compiled on an uncontrolled air photo base which is included in a pocket of the report folder. The map shows the distribution of soil types and associated landscape features that are significant for potential use as field management units. It provides a linkage from landscapes within the study area to the information contained in the report.

To assist the user in retrieving soil information quickly, the following steps are suggested:

If project consists of many individual maps, proceed with STEP 1., if only single map in pocket, proceed with STEP 2 to 6.

STEP 1	Consult the index to map sheets if the report contains many maps. Locate the areas of interest and note the map-sheet number(s) which identify the township and range on each map.
STEP 2	Consult the soil map in pocket of report folder. Locate the area(s) of interest on the map and identify the pertinent map unit symbols. Arabic numerals placed as superscripts following map symbols indicate the approximate proportion of each soil type within the map unit.
STEP 3	Consult the extended legend accompanying the soil map for an alphabetical listing of soil symbols giving the soil name, classification, drainage and related information concerning landforms, nature and depth of materials, and dominant vegetation.
STEP 4	For interpretive information about the soils, consult the appropriate Table in Part 4. Criteria utilized as guidelines in making these interpretations are provided in the Appendix.
STEP 5	Further information concerning the morphological properties and extent of the soils is presented in Part 3 where the soils are described alphabetically according to soil name.
STEP 6	Additional site specific information not contained in this report is available on request from the Canada-Manitoba Soil Survey, Ellis Bldg., University of Manitoba.

SUMMARY

The eastern boundary of the Rural Municipality of North Norfolk is located 17.6 km west of the town of Portage la Prairie. The Trans-Canada Highway transects the municipality in close proximity to the towns of MacGregor, Austin and Sidney which is one kilometre short of the western boundary of North Norfolk Municipality.

This area was originally surveyed at a reconnaissance scale of 2 miles to 1 inch or 1:126,720 and published in the following report:

Report of the Reconnaissance Soil Survey of Carberry Map Sheet Area, Report No. 7 (Ehrlich, Poyser, Pratt, 1957).

Portions of North Norfolk were subsequently remapped at a detailed scale of 4 inches to 1 mile or 1:20,000 and are published in the following soil report:

West Portage and MacGregor Map Areas, Report No. D-20 and D-44 (Michalyna, Langman, Aglugub, 1982).

Areas which have been previously mapped are as follows: In Twp. 12-9W (Sec. 1-12); Twp 12-10W (Sec. 1-3,10-12); All of Twp 11-9W; Twp 11-10W (Sec. 1-7, 10-15, 22-E1/2 29; E1/2 32-36); Twp 11-11W (Sec. NE1/4 19, N1/2 20, NW1/4 21, W1/2 28-E1/2 30); Twp 11-12 W (NW1/4 4, N1/2 5, NE1/4 6, SE 1/4 7, S1/2 8, SW 1/4 9); All of 10-9W; Twp 10-11W (Sec. 10-15, Sec.24); Twp 10-12W (Sec. NE1/4 20, N1/2 21, W1/2 27-E1/2 29, Sec. 33 and 34 excluding the SE 1/4).

This previously published detailed information has been reproduced in the current soil report as originally published with exception of minor corrections.

Field mapping in the current project was initiated in 1987 and completed in the summer of 1988 at a detailed scale of 1:20,000.

The Municipality of North Norfolk is dissected diagonally by the Manitoba Escarpment trending in a southeasterly to northwesterly direction along the 1100 ft. (335 m) contour. Approximately eight of the twelve townships are located below the Escarpment in the lower elevations of the Manitoba Plain Division on level to nearly level topography. The remaining four townships occupy the hummocky, undulating, dissected terrain of the Saskatchewan Plain Division above the Escarpment which exhibits pronounced dendritic drainage in townships 10-11W, 10-12W and 11-12W where the majority of the Organic soils occur.

Surface materials in the extreme northeastern corner of township 12-9W trending in a southeasterly to northwesterly direction grade from clay to stratified clay textures to the 850 ft. (259 m) contour. Stratified clay materials give way to clay loam textured materials to the 875 ft. (267 m) contour where a narrow transitional band of loam textured surface materials grades to dominantly sandy textured soils which extend through to the Manitoba Escarpment.

The topography remains level to nearly level and the sandy deposits are generally shallow (2-3 m) in depth overlying loamy to clayey substrata.

Due to the two different physiographic divisions in the municipality, land use is affected accordingly. The agricultural potential of the clay to loam textured soils is generally good (CLI class 1-3) while that of the sandy textured soils is generally lower ranging from good to poor (CLI class 3-5) due to excessive or poor drainage and wind erosion hazard. Above the 1100 ft. (335 m) contour loam to clay loam textured materials and sandy textured soils are intermixed in the undulating and hummocky topography of the uplands. The clay loam to loam textured areas are relatively better drained than the sandy textured

areas which contain localized undrained depressions, however, due to factors such as steep topography, water and wind erosion the agricultural potential for both types of soils is generally good to poor (CLI class 3-5) with depressional areas unsuitable for agriculture (CLI class 6) due to poor drainage.

SUMMARY OF SOIL SURVEY COVERAGE FOR MANITOBA

JANUARY, 1991

Map Project Designation	Name (Soil Report No.)	Report[1] Status	Area in Hectares	Map Unit[2] Descrip.	Survey[3] Intensity	Map Scale	Map[4] Base	Land Eval.[5] & Interp.
Detailed Studies and Surveys								
D1	Pasquia (No. 11)	Pub. 1960	57 200	a,b,d	3	1:63,360	Color	A
D2	Glenlea Research Station	Int. 1963	541	a,b	1	1:7,920	Photo	A
D3	Morden Experimental Farm	Int. 1961	256	a,b	1	1:12,000	Photo	A
D4	Onanole	Pub. 1968	768	a,b	1	1:7,920	Photo	U
D5	York Factory Area	Int. 1969	768	a	3	1:63,360	B&W	
D6	McCreary Tile Drain Project	Int. 1971	64	a,b	1	1:5,000	B&W	A
D7	Brandon Experimental Farm	Int. 1985	768	a,b	1	1:7,920	Photo	A
D8	Portage Potato Farm	Int. 1972	480	a,b	1	1:4,800	Photo	A
D9	Portage la Prairie (No. 17)	Pub. 1972	113 200	a,b,c	2	1:20,000	Photo	A,I,E,U,R
D10	Morden-Winkler (No. 18)	Pub. 1973	71 424	a,b,c	2	1:20,000	Photo	A,I,E,U,R
D11	Deep Lake	Int. 1975	1 400	a,b	1	1:6,000	B&W	R
D12	Thompson Environmental Study	Int. 1976	32	a,b	1	1:1,000	B&W	
D13	Organic Soil Study of Alexander L.G.D.	Int. 1975	29 456	a,b	3	1:63,360	B&W	A
D14	Winnipeg Region	Pub. 1975	306 000	a,b,c	2	1:20,000	Photo	A,E,U,R
D15	Brandon Region	Pub. 1976	73 250	a,b,c	2	1:20,000	Photo	A,E,U,R
D16	Boissevain-Melita (No. 20)	Pub. 1978	262 912	a,b,c	2	1:20,000	Photo	A,I,E,U,R
D17	Roseau River	Pub. 1977	45 200	a,b	3	1:20,000	B&W	A
D18	Orr Lake	Int. 1977	20	a,b	1	1:1,000	B&W	
D19	Pelican-Rock Lake	Pub. 1983	14 080	a,b	2	1:20,000	Photo	A,E,R,I
D20	West Portage-MacGregor	Pub. 1982	124 866	a,b	2	1:20,000	Photo	A,I,E,R
D21	Minnewasta	Pub. 1978	2 560	a,b	2	1:20,000	Photo	A,E,R,I
D22	Killarney	Pub. 1979	4 600	a,b	2	1:20,000	Photo	A,E,R,I
D23	Matlock-Gimli-Riverton	Pub. 1981	18 400	a,b	2	1:20,000	Photo	A,E,R,I
D24	Glenboro	Pub. 1979	5 960	a,b	2	1:20,000	Photo	A,E,R,I
D25	Sandy Lake	Pub. 1980	1 720	a,b	2	1:20,000	Photo	A,E,R,I
D26	Brokenhead	Pub. 1979	10 813	a,b	2	1:20,000	Photo	A,E,R,I,U
D27	Rockwood	Pub. 1980	12 928	a,b	2	1:20,000	Photo	A,E,R,I,U
D28	Oak Lake	Pub. 1979	1 293	a,b	2	1:20,000	Photo	A,I
D29	Bird River	Pub. 1980	2 560	a,b	2	1:20,000	Photo	A,E,R
D30	North Shore Lac du Bonnet	Pub. 1980	2 400	a,b	2	1:20,000	Photo	A,E,R
D31	Grindstone Point	Pub. 1979	8 223	a,b	2	1:20,000	Photo	A,E,R
D32	Paint Lake	Int. 1980	2 880	a,b	2	1:10,000	Photo	A,E,R
D33	Cranberry Portage	Int. 1980	80	a,b	1	1:5,000	Photo	A,E,R
D34	Dauphin	Pub. 1981	8 005	a,b	2	1:20,000	Photo	A,E,R,I
D35	South Riding Mtn.	Pre.	23 488	a,b	2	1:20,000	Photo	A,E,R
D36	West Interlake	Pub. 1981	10 036	a,b	2	1:20,000	Photo	A,E,I,R
D37	Swan R. Townsite	Pub. 1987	7 680	a,b	2	1:20,000	Photo	A,E,R,I
D38	Hadashville-organic	Pub. 1981	6 475	a,b	3	1:40,000	Photo	A,E,I,R
D40	Falcon L-Brereton L	Pre.	39 311	a,b	2	1:20,000	Photo	A,E,R
D41	Quesnel Lake- North Shore Winnipeg River	Pre.	6 009	a,b	2	1:20,000	Photo	A,E,R
D42	Duck Mountain	Pub. 1982	3 036	a,b	2	1:20,000	Photo	A,E,R
D43	Spruce Woods	Pre.	26 300	c	3	1:40,000	Photo	A,E,R
D45	Pine Creek	Pub. 1983	1 942	a,b	2	1:20,000	Photo	A,E,R,I
D46	Arborg-Riverton	Pub. 1982	2 590	a,b	2	1:20,000	Photo	A,E,R,I
D47	Roblin	Pub. 1983	4 096	a,b	2	1:20,000	Photo	A,E,R,I
D48	Flin Flon	Pub. 1989	4 600	a,b	2	1:20,000	Photo	A,E,R
D49	St. Anne-La Broquerie, Part of L.D.G. Stuartburn	Pub. 1985	105 280	a,b	3	1:50,000	B&W	A,E,R,I
D50	City of Brandon	Pub. 1984	2 980	a,b	2	1:20,000	Photo	A,E,R,I
D51	Westbourne	Pub. 1985	51 456	a,b	2	1:20,000	Photo	A,E,R,I

SUMMARY OF SOIL SURVEY COVERAGE FOR MANITOBA (Cont'd)

Map Project Designation	Name (Soil Report No.)	Report[1] Status	Area in Hectares	Map Unit[2] Descrip.	Survey[3] Intensity	Map Scale	Map[4] Base	Land Eval.[5] & Interp.
D52	Notre Dame, Rathwell, Treherne Townsites	Pub. 1984	6 144	a,b	2	1:20,000	Photo	A,E,R,I
D53	Altona, Emerson, Gretna, Ile des Chenes, Landmark, Letellier, Rosenort, St. Jean Townsites	Pub. 1984	14 080	a,b	2	1:20,000	Photo	A,E,R,I
D54	Russell, Binscarth-Townsites	Pub. 1984	3 791	a,b	2	1:20,000	Photo	A,E,R,I
D55	St. Rose Du Lac-Townsite	Pub. 1985	1 536	a,b	2	1:20,000	Photo	A,E,R,I
D56	Souris, Wawanesa, Virden, Townsites	Pub. 1986	6 400	a,b	2	1:20,000	Photo	A,E,R,I
D57	Fraserwood, Inwood, Komarno Townsites, Lake Man. Shoreline	Pub. 1987	1 856	a,b	2	1:20,000	Photo	A,E,R,I
D58	Hallboro, Minnedosa-Townsites	Pub. 1984	4 544	a,b	2	1:20,000	Photo	A,E,R,I
D59	Beaudry Park	Pub. 1986	640	a,b	2	1:20,000	Photo	A,E,R
D60	Rural Municipalities of Dufferin, Grey, Roland, Thompson and Stanley	Pub. 1988	325 000	a,b	2	1:20,000	Photo	A,E,R,I
D61	Meditation Lake	Pre.	3 072	a,b	2	1:20,000	Photo	A,E,R
D62	Wanipigow Lake	Pre.	8 960	a,b	2	1:20,000	Photo	A,E,R
D63	Shellmouth Resevoir-N	Pub. 1987	4 650	a,b	2	1:20,000	Photo	A,E,R,I
D64	Assiniboine River	Pub. 1987	4 095	a,b	2	1:20,000	Photo	A,E,R,I
D65	Villages of Hamiota,Elkhorn, Strathclair, Rapid City, Newdale, Birtle, Shoal Lake	Pub. 1989	6 204	a,b	2	1:20,000	Photo	A,E,R,I
D66	Benito-Durban	Pre.	18 432	a,b	2	1:50,000	Photo	A,E,R,I
D67	St. Eustache, Springstein, Perimeter Strip, Brunkild, La Salle R.	Pub. 1989	6 300	a,b	2	1:20,000	Photo	A,E,R,I
D68	Spruce Point Mine Area	Pub. 1987	450	a,b	2	1:10,000	Photo	E,R
D69	Snow Lake	Pub. 1990	3 800	a,b	2	1:20,000	Photo	A,E,R,I
D70	Lorne	Pub. 1987	93 240		3,2	1:50,000	B&W,Photo	A,E,R,I
D71	Whitemouth Peatland	Pub. 1987	10 359	a,b	3	1:50,000	Photo	A,E,R,I
D72	Woodlands R.M.	Pre.	9 728	a,b	3	1:50,000	Photo	A,E,R,I
D73	Elk Island-Victoria Beach	Pub. 1990	2 095	a,b	2	1:20,000	Photo	A,E,R,I
D74	South Norfolk R.M.	Pub. 1988	70 912	a,b	2	1:20,000	Photo	A,E,R,I
D75	Victoria R.M.	Pub. 1989	67 328	a,b	2	1:20,000	Photo	A,E,R,I
D76	Rhineland	Pre.	93 241	a,b	2	1:20,000	Photo	A,E,R,I
D77	Pembina	Pre.	108 288	a,b	3	1:50,000	B&W	A,E,R,I
D78	Springfield*	Data	98 270	a,b	2	1:20,000	Photo	A,E,R,I
D79	Rockwood R.M.*	Pre.	116 550	a,c	4	1:125,000	B&W	A,E,R,I
D80	North Norfolk R.M.	Pre.	115 503	a,b	2	1:20,000	Photo	A,E,R,I
D81	Plum Lake	Pub. 1989	15 500	a,b	2	1:20,000	Photo	A,E,R,I
D82	Hanover R.M.	Pre.	8 192	a,b	2	1:20,000		A,E,R,I
		Data	65 536	a,b	3	1:50,000	B&W	A,E,R,I
D83	Louise R.M.	Data	92 416	a,b	3	1:50,000	B&W	A,E,R,I
D84	Argyle R.M.	Data	83 712	a,b	3	1:50,000	B&W	A,E,R,I

* Upgrade of Data Base

SUMMARY OF SOIL SURVEY COVERAGE FOR MANITOBA (Cont'd)

Map Project Designation	Name (Soil Report No.)	Report[1] Status	Area in Hectares	Map Unit[2] Descrip.	Survey[3] Intensity	Map Scale	Map[4] Base	Land Eval.[5] & Interp.
Reconnaissance Surveys								
R1	South Western (No. 3)	Pub. 1940	709 600	d	3	1:125,000	B&W	A
R2	South Central (No. 4)	Pub. 1943	967 600	d	3	1:125,000	B&W	A
R3	Winnipeg and Morris (No. 5)	Pub. 1953	1 419 200	d	3	1:125,000	Color	A
R4	Rossburn and Virden (No. 6)	Pub. 1956	1 372 400	d	3	1:125,000	Color	A
R5	Carberry (No. 7)	Pub. 1957	967 600	d	3	1:125,000	Color	A
R6	West-Lake (No. 8)	Pub. 1958	592 800	d	3	1:125,000	Color	A
R7	Grandview (No. 9)	Pub. 1957	689 200	d	3	1:125,000	Color	A
R8	Nelson River Basin (No. 10)	Pub. 1973	224 000	b	3	1:100,000	Color	A
R9	Fisher and Teulon (No. 12)	Pub. 1961	949 200	a,c	3	1:100,000	Color	A
R10	Swan River (No. 13)	Pub. 1962	316 000	a,c	3	1:125,000	Color	A
R11	South Eastern (No. 14)	Pub. 1964	749 200	a,c	3	1:125,000	Color	A,F
R12	Lac du Bonnet (No. 15)	Pub. 1967	764 800	a,c	3	1:125,000	Color	A,F,R
R13	Grahamdale (No. 16)	Pub. 1971	764 800	a,b	3	1:125,000	Color	A,F,U,R,E
R14	Red Rose-Washow Bay (No.19)	Pub. 1975	704 400	a,b	3	1:125,000	Color	A,F
R15	Boissevain-Melita (No. 20)	Pub. 1978	299 520	a,b	2	1:40,000	Photo	A,I,E
R16	Ste. Rose (No. 21)	Pub. 1981	676 705	a,b	3	1:125,000	Color	A,I,R,E,F
R17	Waterhen (No. 23)	Pub. 1985	949 600	a,b	4	1:125,000	B&W	A,I,R,E,F
R18	Swan Lake	Data	599 200	a,b	3,4	1:125,000	B&W	A
R19	The Pas (No. 22)	Pub. 1982	791 700	a,b	4	1:125,000	Color	A,I,E,R,F
R20	Grand Rapids	Pre.	657 031	a,b	4	1:125,000	B&W	A
R21	Cormorant	Int. 1975	920 000	a,b	4	1:125,000	B&W	A
R22	Wekusko	Pre.	1 400 000	a,b	4	1:125,000	B&W	A
R23	Pointe du Bois	Pre.	740 000	a,b				
R25	Red Deer Lake	Pub. 1966	34 860	a,b	2	1:31,680	Photo	A
R26	Cross Lake and Norway House	Pre.	615 200	a,b	4	1:125,000	B&W	A
R28	Pasquia Lake	Pub. 1984	2 330	a,b	3	1:50,000	B&W	A,E
R29	Duck Mountain For. Reser.	Pre.	363 264	a,b,c	4	1:125,000	B&W	A,F,E,R,I
Biophysical and Exploratory Surveys								
B1	Lake Winnipeg, Churchill & Nelson Rivers	Pub. 1973	3 600 000	e	4	1:250,000 1:50,000	B&W	
B2	Churchill Transportation Corridor	Data 1974	179 000	f	4	1:125,000	B&W	
B3	54C Hayes River	Int. 1976	1 370 300	f	4	1:125,000	B&W	
B4	54D Kettle Rapids	Int. 1976	1 370 300	f	4	1:125,000	B&W	
B5	52M Carrol Lake	Int. 1977	634 000	f	4	1:125,000	B&W	
B5	62P Hecla	Int. 1977	466 200	f	4	1:125,000	B&W	
B6	53D Deer Lake	Int. 1978	629 700	f	4	1:125,000	B&W	
B6	63A Berens River	Int. 1978	848 500	f	4	1:125,000	B&W	
B7	53M Knee Lake	Int. 1978	1 405 900	f	4	1:125,000	B&W	
B8	53L Oxford House	Int. 1978	1 441 100	f	4	1:125,000	B&W	
B8	63H Norway House	Data	540 800	f	4	1:125,000	B&W	
B9	SE 1/4 64A Split Lake	Int. 1979	342 400	f	4	1:125,000	B&W	
B9	63P Sipiwesk	Int. 1979	1 405 900	f	4	1:125,000	B&W	
B10	53E Island Lake	Pre.	1 286 900	f	4	1:125,000	B&W	
B11	63H Norway House	Data				1:125,000	MSS	
E1	Surface Deposits & Soils of Northern Manitoba	Int. 1963		g	5	1:1,267,000	B&W	
E2	Exploratory Terrain Study of Northern Manitoba and Southern Keewatin, N.W.T.	Int. 1974		g	5	1:1,000,000	B&W	

SUMMARY OF SOIL SURVEY COVERAGE FOR MANITOBA (Cont'd)

1. Report Status
    - Pub.-Published Report and Map
    - Int.-Interim Report and Map Available
    - Pre.-Preliminary Map and Legend Available
    - Data-Field Data Available Only

2. Map Unit Descriptions Code
    - a-single series and phases
    - b-series complexes defined as to proportion
    - c-series complexes undefined as to proportion
    - d-associations
    - e-biophysical units (materials and physiography)
    - f-biophysical units (associations & complexes of associations)
    - g-regional and local physiographic units

3. Survey Intensity Levels

Code Name	Scale	Minimum Size Delineation(ha)	Inspection Density (Approx. range)
1 Very detailed	>1:12,000	<1.5	>1 per 3 ha
2 Detailed	1:12,000 to 1:40,000	1.5-16	1 per 3 to 50 ha
3 Semi-detailed	1:40,000 to 1:125,000	16 to 256	1 per 10 to 1 000 ha
4 Reconnaissance	1:125,000 to 1:250,000	256 to 625	1 per 100 to 110 000 ha
5 Exploratory	1:250,000 to 1:1,000,000	625 to 110 000	1 per 300 to 500 000 ha

4. Published Map Base Code
    - Photo-Photomosaic
    - B&W -Black and white line
    - Color-Colored line

5. Land Evaluation and Interpretations Code
    - A-Agriculture Capability
    - E-Engineering
    - F-Forestry
    - I-Irrigation Suitability
    - U-Urban Planning and Community Development
    - R-Recreation

TOTAL HECTARAGE COVERED	1990	To Date
Initial Reconnaissance	-	19,271,010
Initial Detailed survey	-	18,793
Detailed Resurvey	148,480	3,658,598
Biophysical Survey	-	12,521,000

Published Reports and Maps, available at a cost of $4.00 per copy (except Detailed Survey of Winnipeg Region(D14), Brandon Region(D15) and and Boissevain-Melita(No. 20) at a cost of $6.00 each) from:

Queen's Printer,
Statutory Publications Branch,
Manitoba Archives Bldg.,
200 Vaughan St.,
Winnipeg, Manitoba R3C 1T5
Phone:945-3103

Information regarding, Biophysical Land Classification Maps and Reports is available by contacting office of the:

Canada-Manitoba Soil Survey
Department of Soil Science, Ellis Bldg.,
University of Manitoba
Winnipeg, Manitoba, R3T 2N2
Phone: (204) 474-6119
Fax: (204) 275-5817

Preliminary Maps and other field data of Survey Projects in progress available from:

Canada-Manitoba Soil Survey Office
Rm. 362 Ellis Bldg., University of Manitoba
Winnipeg, Man. R3T 2N2
Phone: 474-6115 or 474-6118

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PART 1

1 GENERAL DESCRIPTION OF STUDY AREA

1.1 LOCATION AND EXTENT

The Rural Municipality of North Norfolk is located in south-central Manitoba, between the town of Portage La Prairie to the east and Carberry to the west. The municipality is comprised of townships 10-9W, 10-10W, 10-11W, 10-12W; 11-9W, 11-10W, 11-11W, 11-12W; 12-9W, 12-10W, 12-11W, and 12-12W. These townships cover an area of 115 503 ha and all were mapped at a detailed scale of 1:20,000 (Figure 1).

1.2 PRESENT LAND USE

Land use is primarily agricultural with small areas of woodland, pasture, urban development and recreation. Below the Manitoba Escarpment (Figure 3), land use is dominantly intensive agriculture consisting of cereal grains and special crops. However, sandy deposits of lower agricultural potential are utilized for livestock, forage crops and woodlots. These considerable acreages of sandy soils are subject to wind erosion requiring conservation practises such as wind breaks, summerfallow reduction and maintenance of stubble residue to minimize soil loss.

Above the Escarpment, in dissected areas of this hummocky landscape, livestock, associated pasture and forage crops and woodlots are the dominant land use. In areas of more gentle relief cereal crops as well as special crops occupy the land area.

The small urban centers of MacGregor and Austin supply the agricultural service and recreational needs of the rural population within the municipality.

1.3 RELIEF

The relief in North Norfolk Municipality ranges from 850 ft. (a.s.l.) 259 m (a.s.l.) in the extreme northeast of the municipality to 1225-1250 ft (a.s.l.) 373-381 m (a.s.l.) in the southwestern corner of the municipality above the Escarpment which intersects the map area along the 1100 ft. (335 m) contour trending in a southeasterly to northwesterly direction.

Relative to the Escarpment the landform to the north-northeast portion of the municipality is dominantly level to nearly level (0.5-2.0%) to very gently sloping (2-5%).

Gently sloping to strongly sloping (5-30%) landscapes are common above the Escarpment characterized in part by hummocky topography comprised of sand dunes in localized areas. Dissected areas with pronounced gullies running off the Escarpment exhibit very strong slopes (30-45%).

1.4 DRAINAGE: Surface and Subsurface Hydrology

The steeply sloping Escarpment area extending from the southeast to the northwest through the municipality is drained by several, short, intermittent streams, as well as by a major drain, Squirrel Creek, along with minor tributaries connecting with it (Figure 2). Squirrel Creek drains the Escarpment area towards the north, bypassing the town of Austin on its western edge, eventually flowing into the Whitemud River. Drainage of surface water is influenced by hummocky to undulating topography resulting in rapid drainage on upper slopes, and restricted drainage in associated depressions. Well drained soils occur dominantly above the 1100 ft. (335 m) contour; however, minor imperfect to poorly drained areas do exist as well.

In the northeastern part of the municipality, below the Escarpment, surface drainage is often slow and subsurface water movement is restricted in the level sandy lacustrine deposits giving rise to a high groundwater table resulting in dominantly imperfectly drained soils with minor areas of poorly drained soils. This is due in part to a large inflow of water from above the Escarpment which runs off slowly in the level topography infiltrating rapidly through the sandy surface materials only to be restricted by less permeable subsurface material.

The Willow Bend Creek along with adjoining minor tributaries, primarily drains the area below the Escarpment in the eastern part of the municipality. Pine Creek flowing through the extreme northwestern corner of the municipality drains towards the Whitemud River as does Willow Bend Creek. The Whitemud River eventually drains into Lake Manitoba. Minor stream channels such as Beaver

Creek flowing through the eastern edge of MacGregor and Image Creek slightly further east, along with local sloughs and the system of ditch drains also contribute to improved surface drainage of the area.

1.5 PHYSIOGRAPHY

The Rural Municipality of North Norfolk occurs partly within the Saskatchewan Plain and mostly within the Manitoba Plain physiographic division (Figure 3). The Saskatchewan Plain (E) is subdivided into the Assiniboine River Plain Section (E9) which in turn is subdivided into the Upper Assiniboine Delta subsection (E9.5) which is comprised mainly of hummocky to duned deltaic sands.

The Manitoba Plain Division (D) consists of the Red River Plain Section (D1) which in turn has two subsections in the North Norfolk Municipality. The level to gently undulating deltaic sands of the Lower Assiniboine Deltaic subsection (D1.3) occupy most of the northeastern portion of the map area as opposed to a minor area of level lacustrine sediments which occur in the Red River Valley subsection (D1.2) in the extreme northeast corner of the municipality.

1.6 GEOLOGY: Bedrock and Surficial Deposits

Bedrock geology underlying the surficial deposits in the Rural Municipality of North Norfolk consists primarily of the Amaranth, Reston and Melita Formations belonging to the Jurassic Period within the Mesozoic Era. The surficial deposits vary from 1-30 meters in thickness and consist of deltaic sands above the Escarpment as well as the sandy deposits of the Lower Assiniboine Delta below the Escarpment and the silts and clays which form the lake plain of the Red River Plain. In the extreme south and a small portion of the extreme west of the municipality, bedrock of the Upper and Lower Cretaceous consisting of the Ashville Formation as well as the Swan River Formation within the Lower Cretaceous, both of the Mesozoic Era, underlie deposits of the Upper Assiniboine Delta composed dominantly of deltaic sands, silts and gravels varying in thickness between 1 to 30 meters. (Surficial Geologic Map of Manitoba Map 81-1, Figure 4).

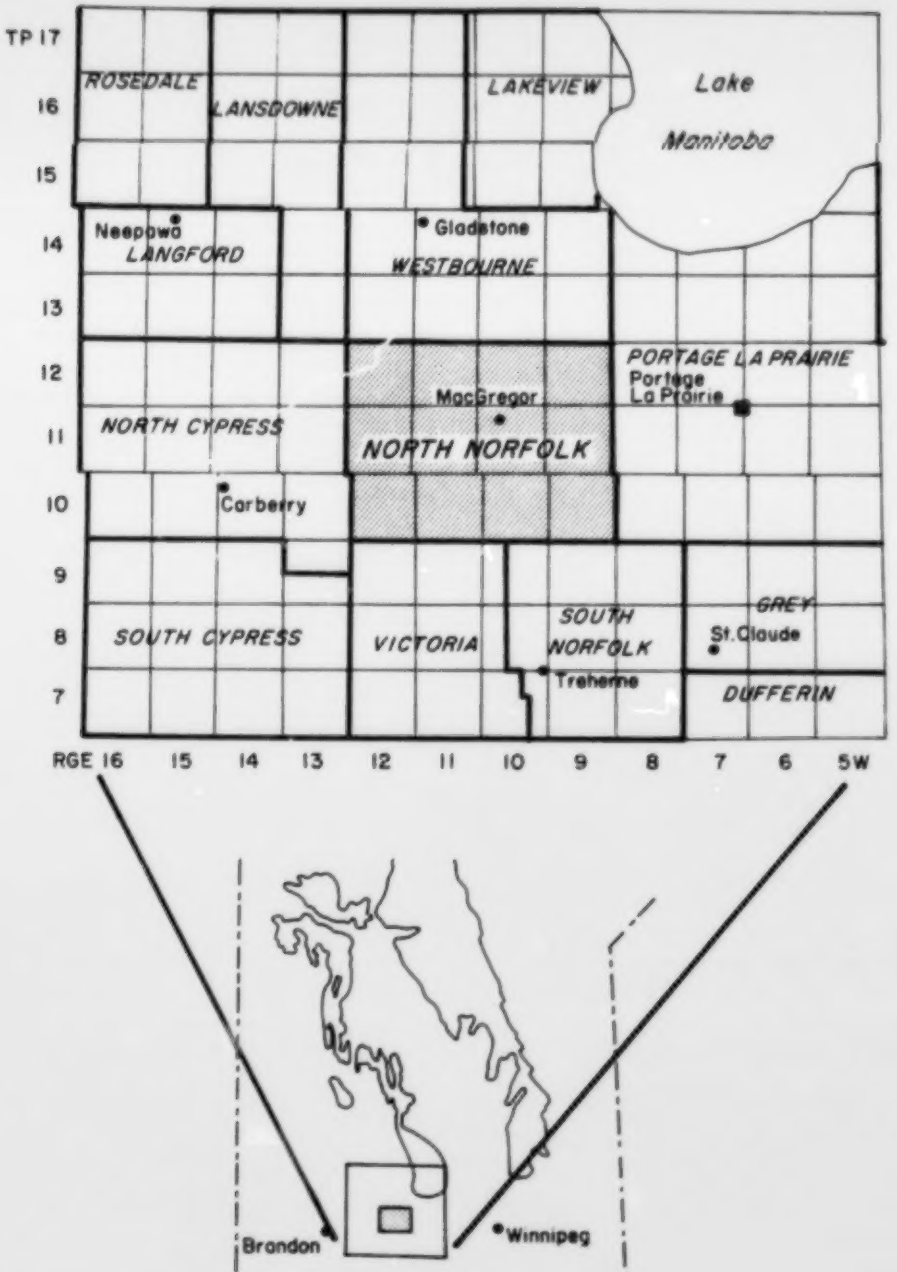

TP 17
16
15
14
13
12
11
10
9
8
7
ROSEDALE
LANSDOWNE
LAKEVIEW
Lake
Manitoba
Neepawa
LANGFORD
Gladstone
WESTBOURNE
PORTAGE LA PRAIRIE
Portage
La Prairie
MacGregor
NORTH CYPRESS
NORTH NORFOLK
Carberry
GREY
SOUTH
NORFOLK
St. Claude
SOUTH CYPRESS
VICTORIA
Treherne
DUFFERIN
RGE 16
15
14
13
12
11
10
9
8
7
6
5W
Brandon
Winnipeg

Figure 1. Location Map of the North Norfolk Survey Area

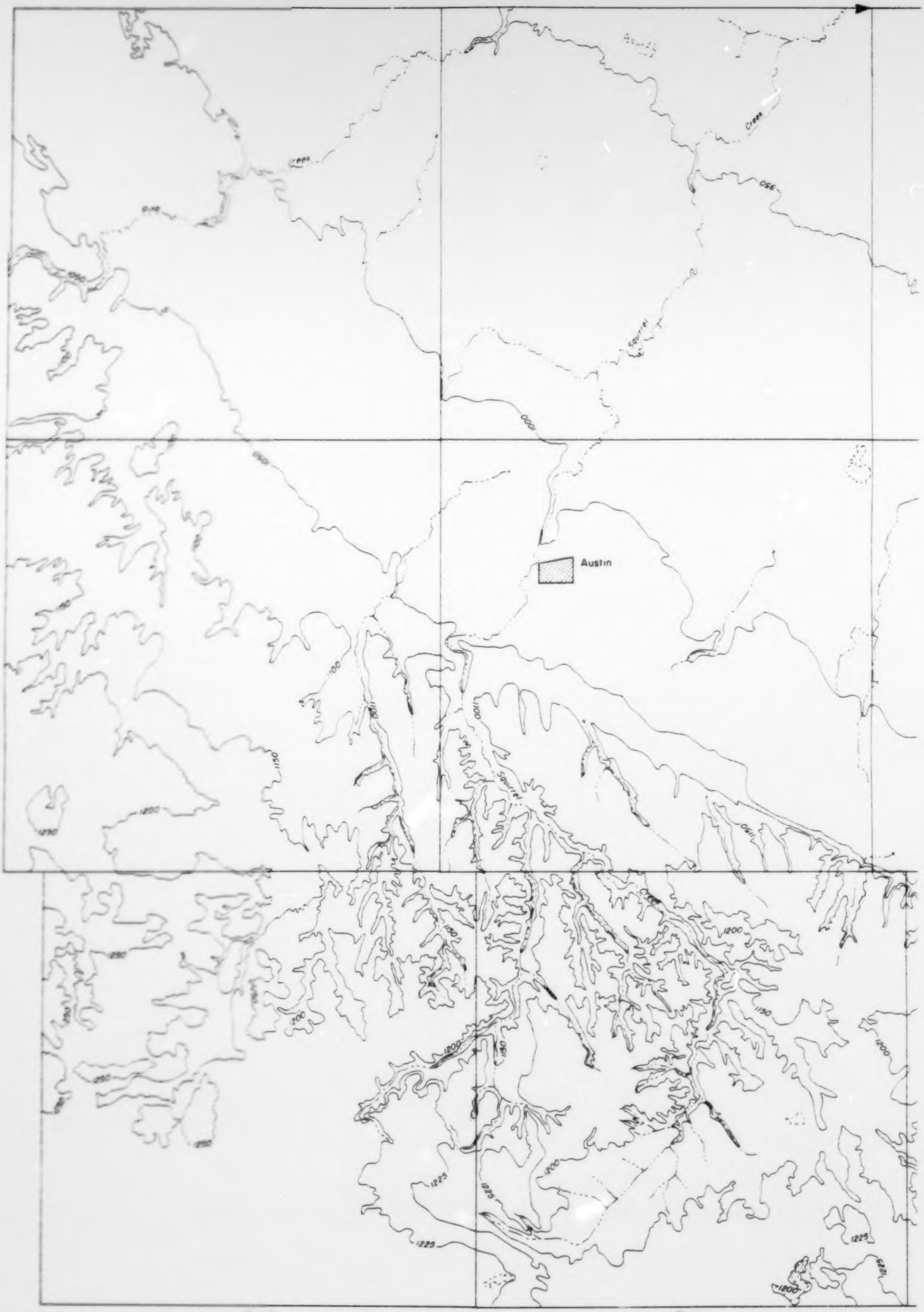
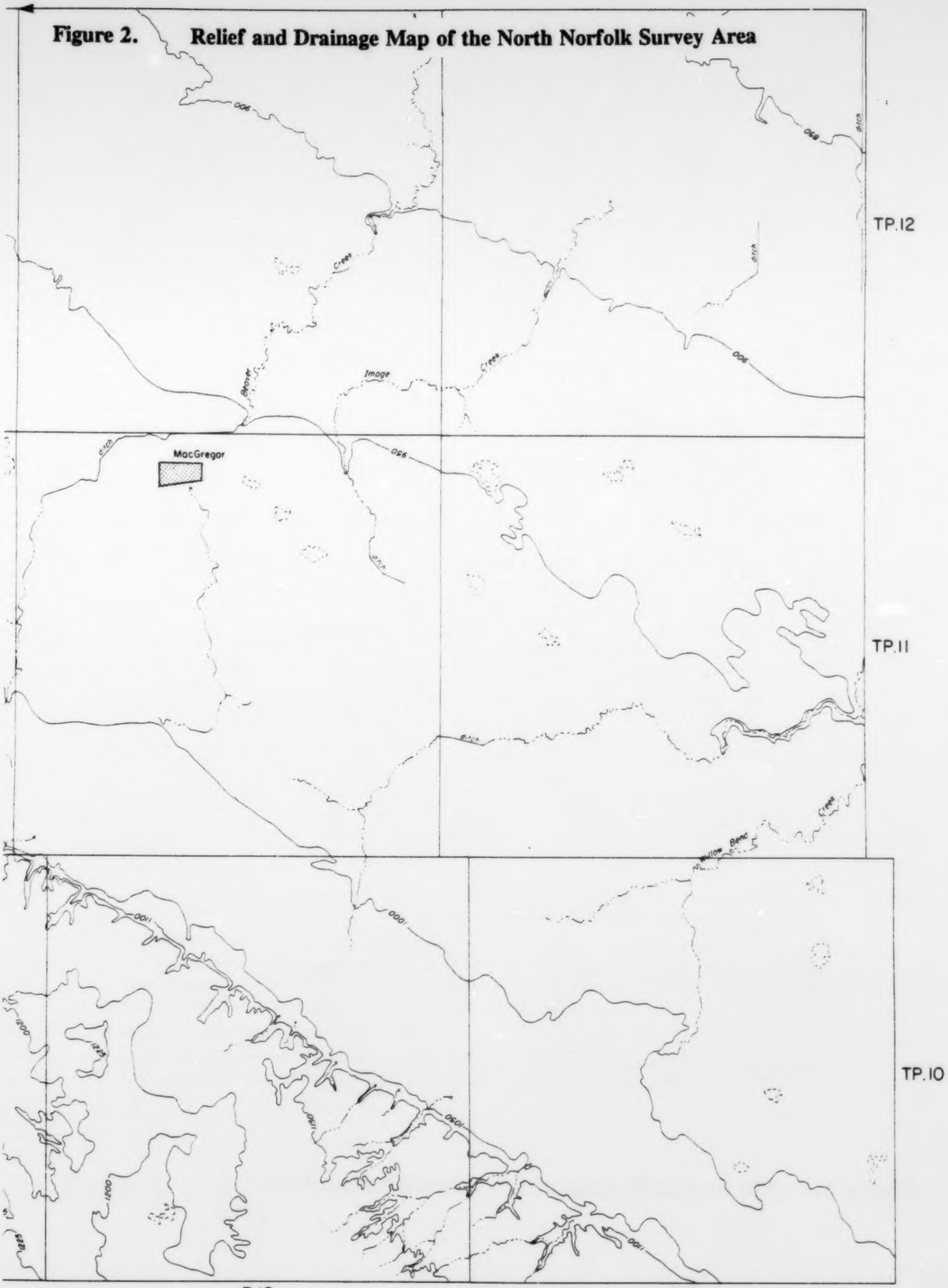
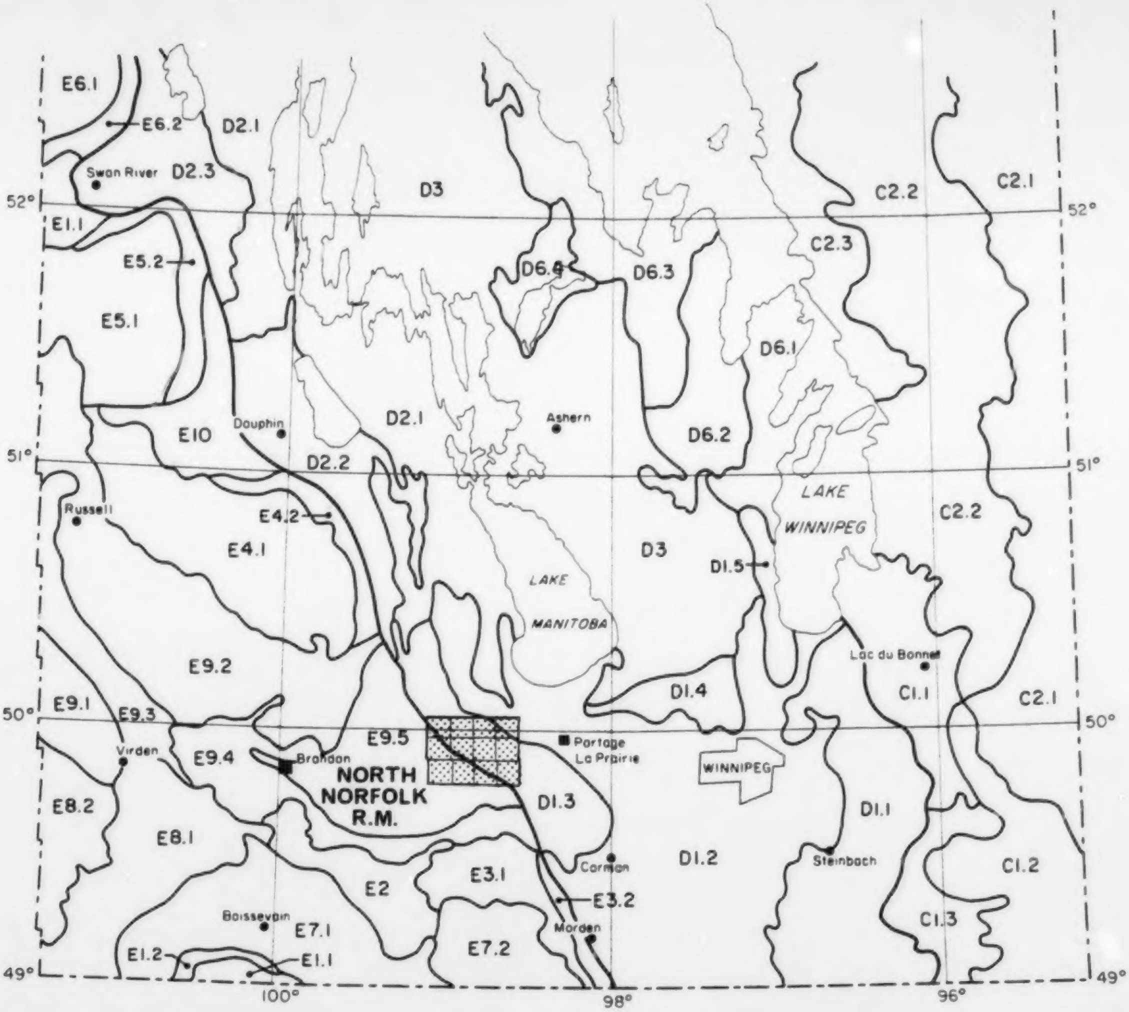

Creek
Creek
950
Squirrel
1000
Austin
1100
Squirrel
1150
1200
1225
R.12
R.11

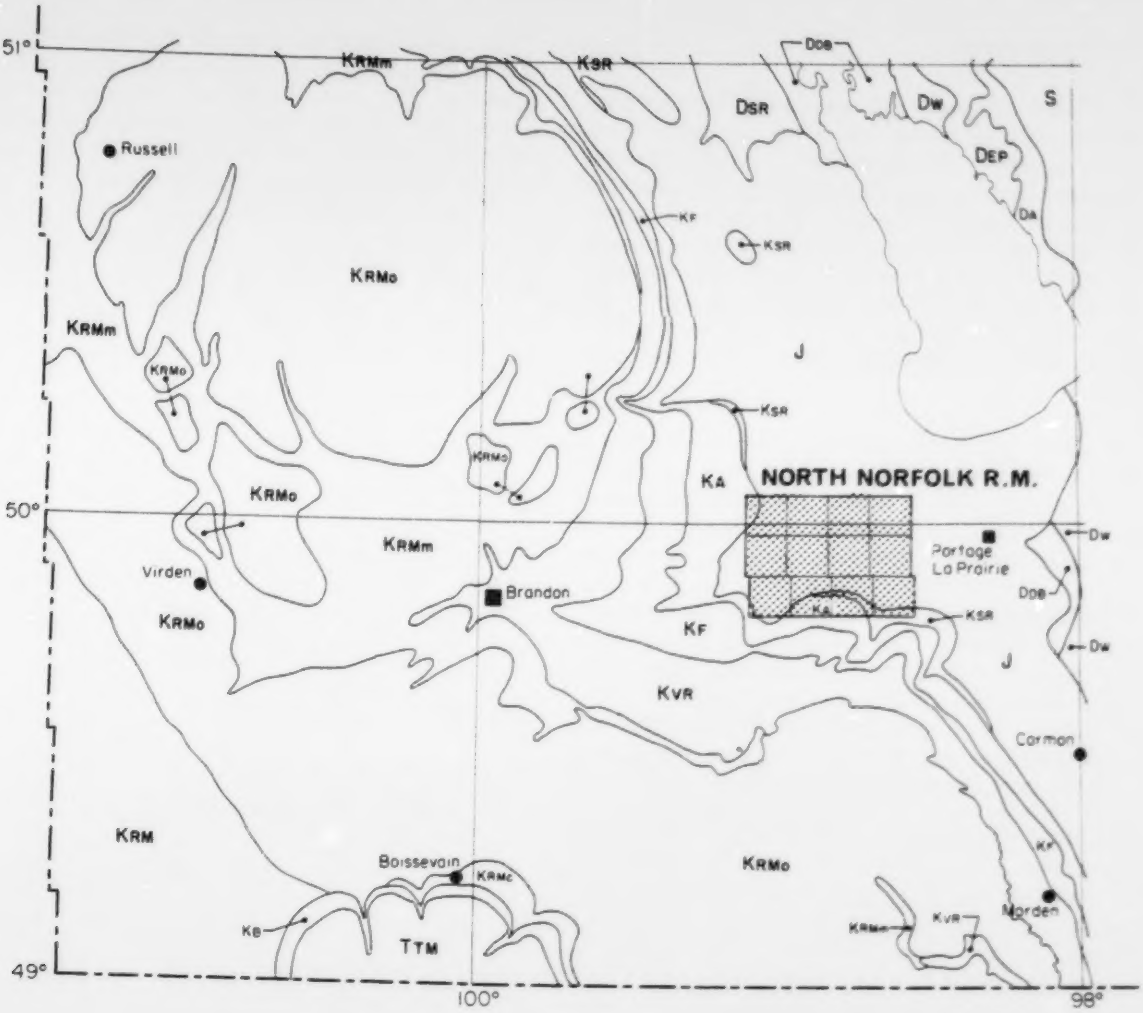
Figure 2. Relief and Drainage Map of the North Norfolk Survey Area


900
Beaver
Creek
Image
Creek
900
950
ditch
ditch
MacGregor
950
ditch
ditch
ditch
Willow Bend
Creek
1000
1100
1200
1250
1150
1050
1200
1250
1100
TP.12
TP.11
TP.10
R.10
R.9


E6.1
E6.2
D2.1
Swan River
D2.3
D3
C2.2
C2.1
52°
E1.1
E5.2
D6.4
D6.3
C2.3
E5.1
D6.1
E10
Dauphin
D2.1
Ashern
D6.2
51°
D2.2
Russell
E4.2
LAKE
WINNIPEG
C2.2
E4.1
D3
D1.5
LAKE
MANITOBA
E9.2
Lac du Bonnet
D1.4
C1.1
E9.1
E9.3
C2.1
50°
E9.5
Portage
La Prairie
Virden
E9.4
Brandon
NORTH
NORFOLK
R.M.
WINNIPEG
E8.2
D1.3
D1.1
E8.1
Carman
D1.2
Steinbach
C1.2
E2
E3.1
E3.2
Boissevain
E7.1
Morden
C1.3
E1.2
E1.1
E7.2
49°
100°
98°
96°

DIVISION	SECTION	SUBSECTION
D. MANITOBA PLAIN	D1. RED RIVER PLAIN	.2 RED RIVER PLAIN
		.3 LOWER ASSINIBOINE DELTA
E. SASKATCHEWAN PLAIN	E9. ASSINIBOINE RIVER PLAIN	.5 UPPER ASSINIBOINE DELTA

Figure 3. Physiographic Map of the North Norfolk Area.


51°
50°
49°
100°
98°
KRMm
KSR
DOB
DSR
Dw
S
DEP
DA
Russell
KF
KSR
KRMo
KRMm
KRMo
J
KSR
KA
NORTH NORFOLK R.M.
KRMo
KRMo
KRMo
Portage La Prairie
Dw
Virden
KRMm
Brandon
KA
KSR
DOB
KRMo
KF
Dw
J
KVR
Carman
KRM
Boissevain
KRMo
KRMo
KF
Morden
KB
TTM
KRMm
KVR

MESOZOIC

CRETACEOUS

Upper and Lower Cretaceous

KA Ashville Formation (55-115m); dark grey carbonaceous shale, in part bituminous; minor sand, silt and bentonite. (Local occurrence of thick bar-type sandstone in subsurface—Ashville or Viking Sand)

Lower Cretaceous

KSR Swan River Formation (0-105m); sandstone, in places glauconitic; kaolinitic shale, minor lignite. May include some non-marine Jurrasic beds in the north. Also includes channel and/or karst fill within Paleozoic outcrop belt. Locally missing from outcrop sequences due to non-deposition.

Jurassic

J Amaranth Formation; red argillaceous dolomitic siltstone and sandstone overlain by gypsum or anhydrite. Reston Formation; limestone and dolomite, shale interbeds. Melita Formation; fine grained sandstone, variegated shale, minor limestone. Total Jurassic thickness 0-280m.

Figure 4. Geology Map of the Rural Municipality of North Norfolk.

1.7 CLIMATE

There are no continuous recording meteorological stations within the Rural Municipality of North Norfolk. However, four stations within the vicinity of the municipality present some indication of climatic norms in the area. The Carberry station is located west of the municipality above the Escarpment, where as the other three, Katrime immediately north of the municipality, Gladstone further to the northwest, and Portage La Prairie to the east are within the Red River Plain section below the Escarpment.

Table 1 presents meteorological data based on annual means of monthly weather summaries for the years 1951 to 1980 inclusive. Rainfall amounts tend to be greater at the lower elevation stations than at the higher elevation station at Carberry. The Portage La Prairie station has a significantly longer frost-free period (>0°C) than either the Gladstone or Carberry station. The average data of last frost (spring) and first frost (fall) are about one week apart between Carberry and Portage La Prairie. Situated in the lower elevations, Portage, also has significantly more annual growing degree days than does Carberry in the higher elevation.

1.8 VEGETATION

Native vegetation of the municipality is classified within the Aspen-Oak section of the Boreal Forest Region (Rowe, 1972). This section is described as a broad transition zone where the boreal forest zone meets the grassland prairie. Aspen is the most prevalent species ranging from small groves invading the grassland through larger and irregular clumps to closed woodland stands. Bur Oak is generally distributed throughout the section. Locally in the Upper Assiniboine Delta portion of the municipality, sand dune areas support scattered mixed wood stands of spruce, aspen, and oak interspersed with prairie vegetation. The Lower Assiniboine Delta is characterized dominantly by meadow prairie and meadow grass associations intermixed with poplar and willow associated with locally moist areas.

Since settlement and development for agriculture, the native vegetation has been extensively modified by man. Large areas have been cleared for production of agricultural crops and the grazing of domestic animals and introduction of new plant species has altered the vegetation in many other areas.

The relationships between climate, vegetation and soil in the map area is summarized by conditions described for the Grassland Transition (Gt) Ecoclimatic Region. These relationships and their effect on the kind and distribution of major soil types in the municipality is described in Section 3.1, Soil Classification and Development.

Table 1. Climatic Data from Weather Stations in the Vicinity of the Rural Municipality of North Norfolk

	Carberry	Gladstone	Katrime	McDonald	Portage La Prairie
Elevation (m)	385	377	270	250	261
Mean Annual Rainfall (mm)	350.9	-	423.1	373.8	368.0
Mean Annual Total Precipitation (mm)	472.3	-	509.0	481.9	463.7
Mean Annual Daily Maximum Temperature (°C)	8.0	-	-	-	8.0
Mean Annual Daily Minimum Temperature (°C)	-3.8	-	-	-	-2.8
Mean Annual Daily Temperature (°C)	2.1	-	-	-	2.5
Frost-free Period (days)	117	109	-	-	131
Average Date of Last Frost (Spring)	May 23	May 24	-	-	May 17
Average Date of First Frost (Fall)	Sept. 18	Sept. 11	-	-	Sept. 26
Mean Annual Growing Degree Days	2710	-	-	-	2829.7

Environment Canada, 1982. Canadian Climatic Normals; Vol. 2 Temperature, Vol. 3 Precipitation, Vol. 4 Degree-Days, Vol. 6 Frost, Atmospheric Environment Service.

PART 2

2 METHODOLOGY

2.1 MAPPING AND MAP SCALE

Detailed (1:20,000 scale) soil mapping was conducted in the Rural Municipality of North Norfolk. This mapping was produced by examining soils to at least one meter depth at approximately 150 meter intervals along two traverses per section as well as at every 0.4 km along road allowances. The resulting inspection density is approximately one observation per 10 ha. Therefore, most soils and many phases are encountered during field observations and become identified components of map delineations. Generally, there are fewer unidentified inclusions in a detailed map than in a semi-detailed map when comparing the same level of natural soil variability. Cartographic limitations of detailed maps prevent the delineation of any feature smaller than 6.25 ha in area (Mapping Systems Working Group, 1981).

Detailed soil maps provide soil information which can be used for many purposes from broad regional planning to "farm-gate" decisions. Detailed mapping was utilized in this area because current intensive land use patterns and anticipated future land use concerns require a detailed and reliable soil resource map.

Detailed surveys proceed at approximately 256 ha per field-man-day, therefore, they are more time consuming and more costly to produce. Subsequently, detailed surveys are only conducted in areas where intensive and highly reliable soil information is needed for land use decisions.

2.2 MAP UNITS

A map represents mappable portions of the soil landscape that together have characteristics and properties varying within more or less narrow limits that are determined by the intensity of the survey. A map unit contains predominantly one or more than one soil or nonsoil individual plus a certain proportion (varying within prescribed limits) of unnamed and undescribed inclusions. They are delineated on the basis of the types and relative proportions of their soils or nonsoils, as well as on the basis of external criteria such as slope, stoniness or erosion.

Soil maps show the distribution of kinds of soils and, as such, serve as a link so that the knowledge gained in one locality about the usefulness or behaviour of a kind of soil can be extended to other bodies of the same soil.

A map unit comprises all delineations that contain exactly the same symbol. This includes all the symbols denoting soils, nonsoils, phases and deciles. While they represent real portions of the landscapes, most map units are concepts because their total range of properties is made up of the aggregate of all their delineations and no one delineation will contain the full range of properties. The proportions of each of the component soils and nonsoils and undescribed inclusions may vary within reasonable limits from one delineation to another.

A map unit is named from its principal component soils or nonsoils. It is described in terms of the properties of these components, their relative proportions and other external land attributes. In this project, units are described in terms of named soil series and phases of soil series.

The soil series is defined as a naturally occurring soil body such that any profile within that body has a similar number and arrangement of horizons whose colour, texture, structure, consistence, reaction and composition are within a narrowly defined range.

Map units will always contain small proportions of inclusions. These inclusions may be soil or nonsoil mapping individuals that are named and have their own map units elsewhere in the survey, or soils or nonsoils that are not recognized and named at all in the survey. They may, however, be mentioned in the description of soil types in the report.

2.3 SIMPLE AND COMPOUND MAP UNITS

There are two major types of map units, simple and compound. The difference between them is defined in terms of the proportion and contrast of their components.

A Simple Map Unit contains predominantly one soil or nonsoil. The proportion of its components vary according to their areal extent and contrasting characteristics as they may affect soil management or use.

Its components vary as follows: the predominant component comprises at least 65 percent with up to 35 percent of nonlimiting, similar components (components are alike in most properties and behaviour), or up to 25 percent of nonlimiting dissimilar components (components do not affect management of the map unit but have a significant number of properties that vary from the predominant component), or up to 15 percent of limiting, dissimilar components (components have many contrasting properties and usually affect management differently).

A Compound Map Unit contains predominantly two soils or nonsoils (or a combination of both). The proportions of the two major components may vary from one considerably exceeding the other to both being approximately equal. Complementary to the definition of a single map unit, the proportions of its components vary according to their areal extent and contrasting characteristics. As they may affect soil management or use its major components vary as follows: if other components are similar and nonlimiting no single component represents more than 65 percent: or if other components are dissimilar and nonlimiting no single component represents 75 percent; or if other components are dissimilar and limiting no single component represents 85 percent.

A soil or nonsoil may occur in more than one compound unit. The complex nature of soil landscapes requires that the surveyor be allowed the freedom to describe their combinations as they occur. For the purpose of describing compound map units, components are considered dominant if they occupy over 40 percent of the unit, significant from 15-40 percent and minor if they occupy less than 15 percent. Minor components are described only if they are highly contrasting.

2.4 PHASES

It is frequently desirable to indicate by map unit symbol, a condition or quality of soil property or landscape feature that deviates significantly from the normal definitions of map units. These indicated variations or phases of soil properties and landscape features, varying from delineation to delineation, significantly affect soil behaviour and land management or use.

It is not always easy to maintain a clear distinction between a soil phase and a land phase. Soil properties that are frequently used as phase criteria include texture, depth, surface peat, salinity and physical disruption. Properties of land that are used include slope, wind and water erosion, stoniness, rockiness and altered drainage.

In this study the effect of four properties and land features are shown as a character in the denominator of the map unit symbol and described outside the main soil map legend. The four properties and features are erosion, slope class, degree of stoniness and salinity. The degree or magnitude of each is designated in the following manner.

Erosion

x - noneroded or minimal
1 - weakly eroded
2 - moderately eroded
3 - severely eroded
o - overblown

Slope Class

x - 0 to 2% level to nearly level
c - 2 to 5% very gently sloping
d - 5 to 9% gently sloping
e - 9 to 15% moderately sloping
f - 15 to 30% strongly sloping
g - 30 to 45% very strongly sloping
h - 45 to 70% extremely sloping

Stoniness

x - nonstony
1 - slightly stony
2 - moderately stony
3 - very stony
4 - exceedingly stony
5 - excessively stony

Salinity

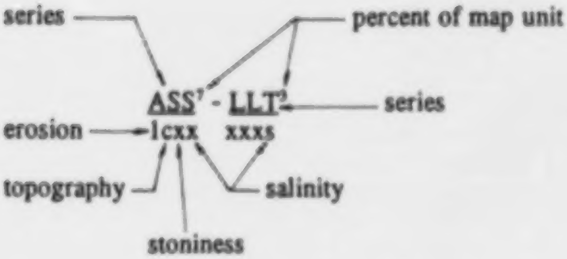
x - nonsaline (0-4 mS/cm)
s - slightly saline (4-8 mS/cm)
t - moderately saline (8-15 mS/cm)
u - strongly saline (>15 mS/cm)

The convention employed to indicate these features in the map symbol is as follows:

If none of the above properties are observed to be significant the map symbol representing the normal or unaffected soil series is used alone without modifiers.

If one or more phase features are recognized the appropriate letter or number is placed below the soil series symbol in one of four designated locations in the map unit symbol. The designated order is erosion, slope class, stoniness and salinity. If a particular feature is not observed to be significant, an x is used in its appropriate designated location in the map symbol.

For example, the compound map unit coded:



Decoding of this symbol explains that an estimated 70 percent of this compound map unit contains Almasippi soils (ASS) on slightly eroded (1), 2 to 5 percent slopes (c), which are nonstony (x); and approximately 30 percent of the map unit is slightly saline(s) Lelant soil (LLT) on level, noneroded, nonstony land.

Detailed definitions for erosion, topography, stoniness and salinity phase classes are given in the Glossary (Appendix A).

2.5 SAMPLING

During the course of field investigations and mapping, selected surface and subsurface soil samples were collected for laboratory analysis. These samples were used as benchmark references for specific soil attributes and to assist in general soil characterization. Detailed soil sampling, description, and laboratory analysis was performed on selected modal soil sites to provide examples of common soil physical and chemical characteristics in the study area. Results of these analyses can be obtained by contacting the Canada-Manitoba Soil Survey at the address listed in the Preface to this report.

An intensive physical and chemical characterization was conducted at these sites to an average depth of 1 to 1.5 m. Field evaluations commonly included:

- soil classification
- soil colour
- soil horizonation
- soil structure
- soil drainage/water table characteristics
- clay films
- concretions, nodules and cast descriptions
- root description
- landscape features and land use
- stoniness and rockiness
- soil erosion

Laboratory evaluations commonly included:

- pH
- organic carbon
- total N
- calcium carbonate equivalent
- calcite and dolomite
- cation exchange capacity
- exchangeable cations
- extract determinations
    - calcium
    - sodium
    - manganese
    - chloride
- nitrate - N
- particle size analysis
- bulk density
- atterberg limits
    - plastic limit
    - liquid limit
- shrinkage limit
- moisture content

Additional specialized laboratory or field analyses were performed on some profiles to assess specific soil attributes.

Soils suspected of being sufficiently saline to inhibit agricultural potential were sampled at depths of 10 to 25 cm, 50 to 60 cm and 100 to 120 cm. These samples were analyzed for electrical conductance and soluble salt content in order to characterize soil salinity.

PART 3

3 DEVELOPMENT, CLASSIFICATION AND DESCRIPTION OF SOILS

3.1 SOIL CLASSIFICATION AND DEVELOPMENT

The principal factors affecting soil formation are climate, vegetation, parent material, relief and drainage. The interaction of these soil forming factors is expressed in the morphological characteristics of soil. Through observation of these characteristics, it is possible to classify soils into natural units and to infer their genesis or the processes involved in their formation.

The relationships existing between climate, vegetation and soil in Manitoba are reflected in the Ecoclimatic regions identified and defined by the Canada-Manitoba Soil Survey (unpublished data). The Rural Municipality of North Norfolk is located dominantly in the Grassland Transition (Gt) Ecoclimatic Region of the Grassland Ecoprovince (Figure 5). This ecoclimatic region ranges in soil climate from Boreal cool to moderately cool subhumd conditions. In North Norfolk the atmospheric climate of the Grassland Transition Ecoclimatic Region is relatively cool and dry in the southwest part of the municipality (subregion Gt_3), gradually shifting to slightly warmer and more moist conditions with a longer frost-free period in the northeast (subregion Gt_4).

Soils of the Grassland Transition are dominantly Black Chernozems developed on calcareous sandy deposits to coarse to fine loamy lacustrine sediments. In subregion Gt_4, soil development is limited in dunes where a clayey subsurface often causes seasonal high water tables. Soils in this area are dominantly Regosols and Gleysols whereas significant areas of Chernozemic Blacks occur on relatively better drained positions occupying more level landscapes. Figure 6 illustrates a cross sectional sequence of soil development occurring on these shallow sandy deposits. Figure 7 presents the typical landscape position of each soil series.

Weakly developed soils in recent alluvial sediments adjacent to rivers and streams are dominantly Regosolic. A typical sequence of soils found adjacent to a stream is shown in Figure 8.

However, in subregion Gt_3, above the Escarpment, Chernozemic Dark Gray (Degraded) soils characteristic of Boreal environments dominate in dissected landscapes because of better drainage, slightly cooler temperatures and a dominance of forest vegetation. Figure 9 illustrates a typical sequence of Dark Gray soils. Poorly drained sites are common and are characterized by Humic Gleysols. Saline soils, although of local importance, are minor in extent.

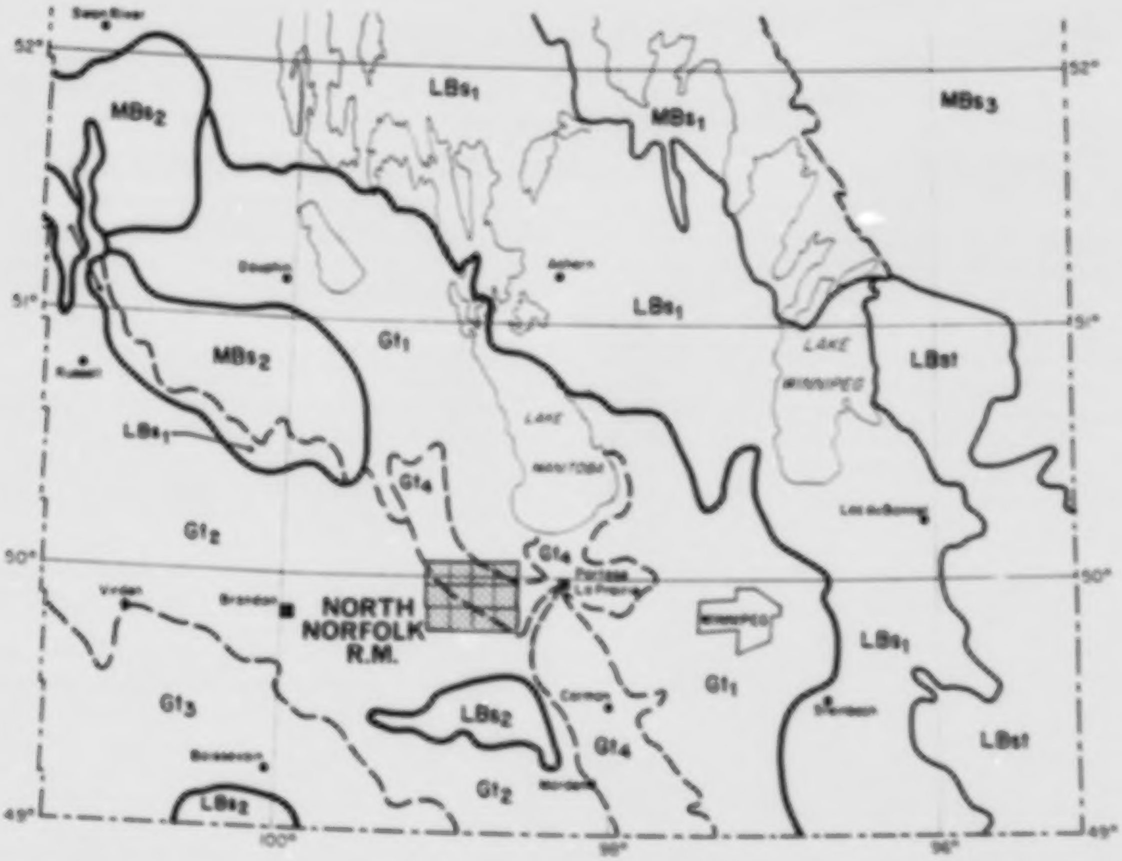
3.2 GENERALIZED SOIL MAP AND SOIL RELATIONSHIPS

Figure 10 is a 1:250,000 scale generalized soils map depicting the regional distribution of soil groupings.

Generalized soil groups are used to describe areas of similar major diagnostic soil characteristics such as drainage, parent material and taxonomy at the Great Group level. The soil group name assigned to each map delineation is generalized from the dominant soils identified in the area on the detailed soil maps. Soil phases, subdominant components of compound map units and small soil areas are not recognized on the generalized soils map.

The generalized soil map provides an overview of general soil distribution for the Rural Municipality of North Norfolk on one map sheet. This map is useful for broad-scale planning such as regional agricultural planning, regional engineering and recreational planning or for municipal development plans.

Black Chernozem and Regosol soils dominate in the glaciolacustrine sands which occur in the Lower Assiniboine Delta below the Escarpment in the central to northeast portion of the Rural Municipality of North Norfolk. Gleysolic soils also occur in significant proportion. Regosolic soils are of local occurrence in the recent alluvial sediments along Pine Creek in the northwest part of the municipality, Squirrel Creek in the central part and along Willow Bend Creek in the eastern part. Above the Escarpment in the Upper Assiniboine Delta, Dark Gray and Black Chernozemic soils develop on hummocky and dissected glaciolacustrine silts and loams in the southwestern part of the municipality. Regosolic soils dominate on the hummocky, duned, eolian sand deposits above the Escarpment with Dark Gray


Swan River
52°
52°
LBs$_1$
MBs$_2$
MBs$_1$
MBs$_3$
Dauphin
Ashern
51°
51°
LBs$_1$
Gt$_1$
MBs$_2$
Russell
LAKE
WINNIPEG
LBst
LBs$_1$
LAKE
MANITOBA
Gt$_4$
Lac du Bonnet
Gt$_2$
50°
50°
Gt$_4$
Portage
La Prairie
Virden
Brandon
NORTH
NORFOLK
R.M.
WINNIPEG
LBs$_1$
Gt$_1$
Carman
Steinbach
Gt$_3$
LBs$_2$
Gt$_4$
LBst
Boissevain
Morden
Gt$_2$
LBs$_2$
49°
49°
100°
98°
96°

Ecoclimatic Region[1]	Subregion[2]	Dominant Soils	Soil Climate Temperate Class	Soil Climate Moisture Subclass	Vegetation Zone
GRASSLAND TRANSITION	Gt 1,2,3,4	Chernozemic Black, Gleysols	Boreal, cool to moderately cool	Subhumid	Grassland and Aspen Parkland
LOW BOREAL subhumid	LBs 1,2	Chernozemic Dark Gray Brunisolic Organic	Cryoboreal, moderately cold	Subhumid transition	Grassland-forest
LOW BOREAL, subhumid transition	LBst	Brunisols, Luvisols Chernozemic Dark Gray, Gleysols Organic	Cryoboreal, moderately cold	Humid to subhumid	Mixed Deciduous - Coniferous Forest
MID BOREAL, subhumid	MBs 1,2,3,4	Luvisolic, Brunisols, Organic	Cryoboreal, moderately cold	Subhumid to humid	Mixed Deciduous - Coniferous forest

[1] Ecoclimatic Regions of Manitoba. Canada-Manitoba Soil Survey 1985. Unpublished data, revised, 1987.

[2] Subregions reflect climatic influence which is expressed in local soil and vegetation relations and which affect land use, management and potential biomass production.

Figure 5. Ecological Regions of the Study Area.

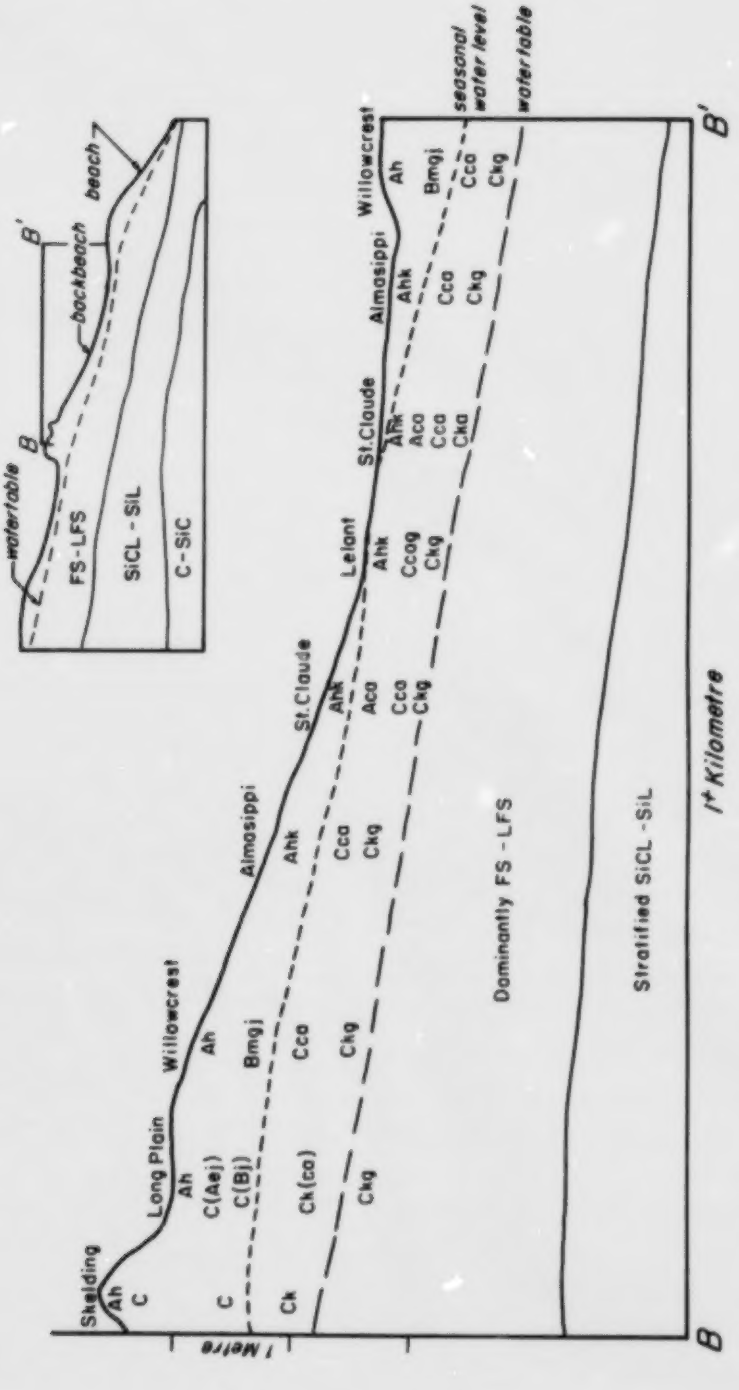

waterlable
B
B'
backbeach
beach
FS-LFS
SiCL-SiL
C-SiC
Skelding
Long Plain
Willowcrest
Almasippi
St.Claude
Lelant
St.Claude
Almasippi
Willowcrest
Ah
C
Ck
C(Aej)
C(Bj)
Ck(ca)
Ckg
Bmgj
Cca
Ahk
Aca
Ccag
Ckg
seasonal water level
watertable
Dominantly FS-LFS
Stratified SiCL-SiL
1 Metre
1+ Kilometre
B
B'

Figure 6. General diagram of the Soil Series of the Almasippi Association as influenced by slope position and water table.

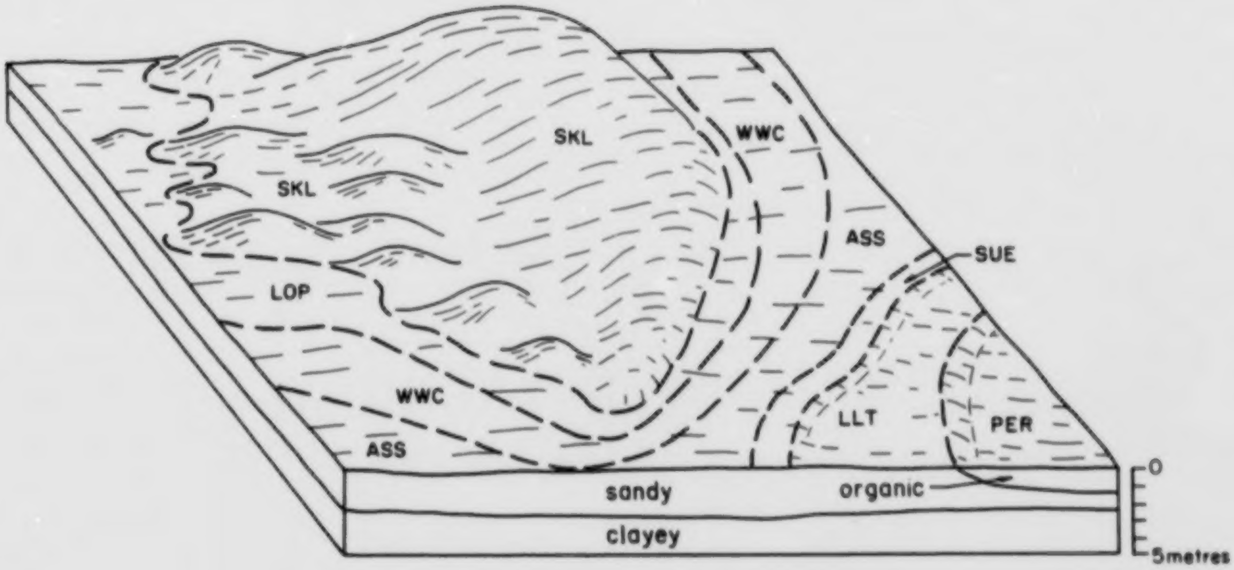

SKL
WWC
SKL
ASS
SUE
LOP
WWC
LLT
PER
ASS
sandy
organic
clayey
0
5metres

Figure 7. Typical pattern of soils and underlying material in the Lower Assiniboine Delta.

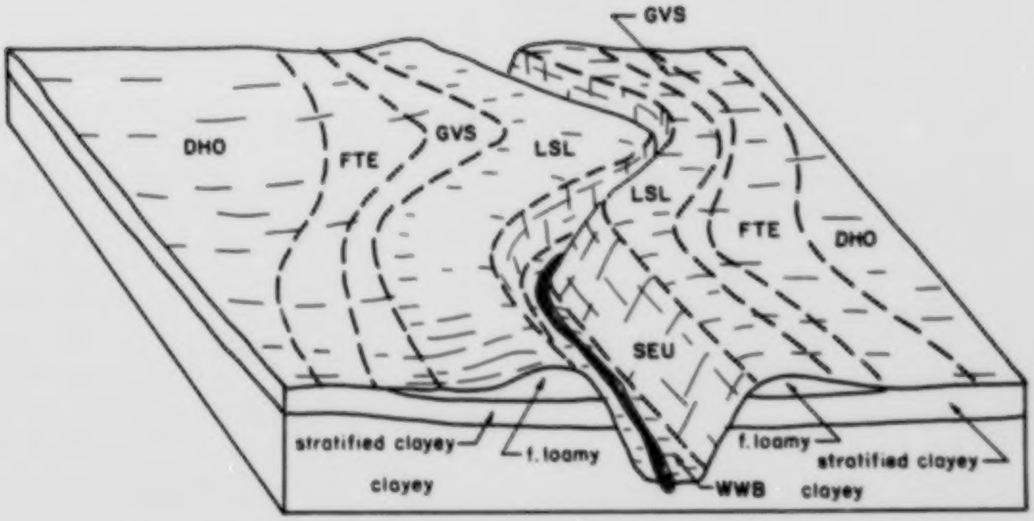

GVS
DHO
FTE
GVS
LSL
LSL
FTE
DHO
SEU
stratified clayey
f. loamy
f. loamy
stratified clayey
clayey
WWB
clayey

Figure 8. Typical pattern of soils and underlying material associated with stream channels.

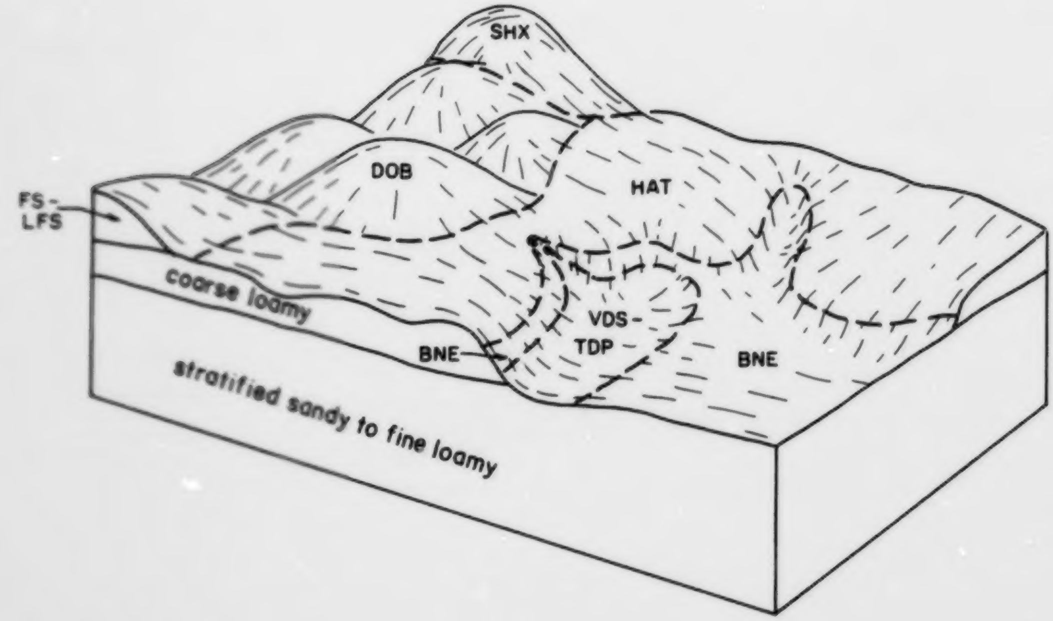
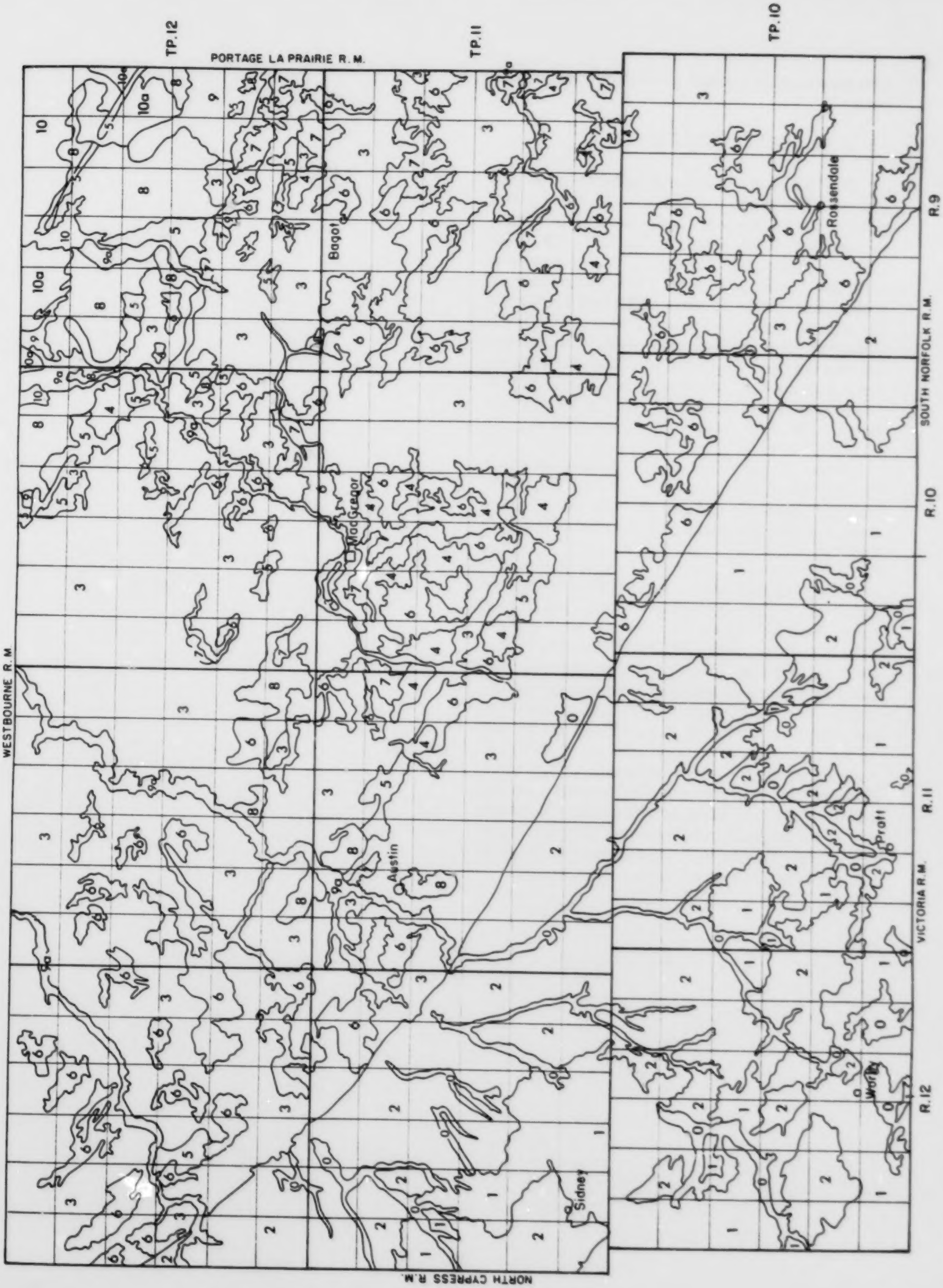

SHX
DOB
HAT
FS-
LFS
coarse loamy
VDS
TDP
BNE
BNE
stratified sandy to fine loamy

Figure 9. Typical pattern of soils and underlying material in the Upper Assiniboine Delta.

Figure 10. Generalized Soils Map.

LEGEND FOR GENERALIZED SOILS MAP

Map Symbol	Soil Materials	Predominant Soil Series	Description - Soil Groups, Occurrence
0	Organics	Perillo, Xavier, Marsh Complex	Very poorly drained Organic Mesisol soils and organic phases of mineral soils. Majority of organics occur above the Escarpment.
1	Eolian and Lacustrine Sands	Shilox, Dobbin	Well drained Regosols occurring in duned landscapes and Dark Gray Chernozems occurring on gently undulating landscapes adjacent to eolian sand areas. These soils occur above the Escarpment in Eco-climatic Subregion Gt_2.
2	Lacustrine loamy (coarse loamy, coarse silty, fine loamy, fine silty) sediments	Halstead, Firdale	Well drained Dark Gray Chernozems occurring on level to gently undulating landscapes above the Escarpment.
3	Lacustrine sands	Almasippi, Willowcrest, Long Plain, Lelant	Imperfectly drained Black Chernozems, Regosols and poorly drained Gleysols occurring on level to nearly level landscapes below the Escarpment in Ecoclimatic Subregion Gt_1 and Gt_4.
4	Lacustrine coarse loamy deposits	Reinland, Kronstal, Osterwick	Imperfectly drained Black Chernozems and poorly drained Gleysols occurring on level to nearly level landscapes below the Escarpment.
5	Lacustrine sandy to coarse loamy deposits overlying clayey sediments	Rosebank, Elm Creek	Imperfectly drained Black Chernozems occurring on level to nearly level landscapes below the Escarpment.
6	Lacustrine loamy (coarse loamy, coarse silty) sediments overlying sandy deposits	Neuenberg, St. Claude, Jasset	Imperfectly drained Black Chernozems occurring on level landscapes below the Escarpment.
7	Lacustrine loamy sediments (coarse loamy, coarse silty grading to fine loamy, fine silty)	Gnadenthal, Reinfeld, Blumenfeld	Dominantly imperfectly drained Black Chernozems with minor areas of well drained Black Chernozems and poorly drained Gleysols occurring on level to nearly level landscapes below the Escarpment.
8	Lacustrine loamy sediments overlying clayey sediments	Graysville, Rignold	Imperfectly drained Black Chernozems occurring on level landscapes below the Escarpment.
9	Lacustrine loamy (fine loamy, fine silty) sediments	Neuhorst, Rathwell, Eigenhof	Imperfectly drained Black Chernozems and minor areas of well drained Black Chernozems occurring on level landscapes below the Escarpment.
9a	Recent fluvial loamy sediments	Gervais, Willowbend	Imperfectly drained Regosols and poorly drained Gleysols occurring on level to nearly level landscapes below the Escarpment.
10	Lacustrine clayey sediments	Red River, Scanterbury, Osborne	Imperfectly drained Black Chernozems and poorly drained Gleysols occurring on level landscapes below the Escarpment.
10a	Lacustrine clayey, stratified, sediments and recent fluvial clayey sediments	Deadhorse, Plum Coulee, Fortier	Imperfectly drained Black Chernozems and Regosols occurring on level landscapes below the Escarpment.


PORTAGE LA PRAIRIE R.M.
WESTBOURNE R.M.
NORTH CYPRESS R.M.
VICTORIA R.M.
SOUTH NORFOLK R.M.
TP.12
TP.11
TP.10
R.12
R.11
R.10
R.9
Bagot
MacGregor
Austin
Sidney
Pratt
Rossendale
Worley

Chernozems also occurring in significant proportions.

3.3 SOIL SERIES DESCRIPTIONS

Soil series are listed in alphabetical order and include descriptions of the genetic soil profile, texture, parent material, drainage, surface runoff, permeability, topography and land use. Additional information includes a listing of closely associated soils and similar soils with a brief description of their differentiating features. Each soil profile has a range of soil characteristics within the limits diagnostic of the series after which it is named. Information pertaining to the suitability and management of each soil for agriculture, engineering uses or recreational applications is presented in Part 4 of this report.

Table 2 provides an abbreviated reference showing the relationship among soil drainage, parent material, taxonomy and soil series name. A more comprehensive presentation of this relationship is in Table 3.

The soils information in these tables reflects the influence of minor subregional climate occurring in North Norfolk. Soils northeast of the Manitoba Escarpment develop in Grassland Transition Subregions (Gt$_1$ and Gt$_4$. These slightly warmer and more moist subregions promote the development of dominantly Black Chernozems. The soils of these two subregions are combined in the soils legend because of their physiographic proximity and similarity in soil development. Soils to the southwest and above the Manitoba Escarpment develop in a relatively cool and dry Grassland Transition Subregion (Gt$_2$) which includes outliers of well drained, deeply leached soils developed under forest vegetation and which exhibit Dark Gray Chernozemic characteristics.

Table 2a. Key to the soils of Ecoclimatic Subregions Gt1 and Gt4 in the Rural Municipality of North Norfolk according to Drainage, Subgroup and Parent Material.

Drainage / Parent Material \ Subgroup	Well to moderately well drained Orthic Regosol	 Cumulic Regosol	 Orthic Black	 Calcareous Black
A. FLUVIAL GRAVELS				
1. Sandy to Sandy-Skeletal** (S,CS) to (GrS,GrCS)***				Birkenhead(BKA)
B. LACUSTRINE SANDS				
1. Sandy** (FS,LFS,LS)***	Skelding(SKL)	Arnaud(ARN)		
C. LACUSTRINE LOAMS				
1. Coarse loamy** (VFS,LVFS,FSL,SL)***				
2. Sandy/coarse loamy over clayey** (FS,LFS,LS)/(VFS,LVFS, FSL,SL) over (C,SIC)***			Hibsin(HIN)	
3. Loamy over Sandy (VFSL,L,SiL) over (FS,LFS,LS)				
4. Loamy (gradational) (VFSL,L,SiL)grading to (CL,SiCL,SCL)			Reinfeld(RFD)	
5. Loamy over clayey (VFSL,L,SiL,CL,SiCL, SCL) over (C,SIC)			Denham(DNH)	
6. Fine loamy over sandy (CL,SiCL,SCL) over (FS,LFS,LS)				
7. Fine loamy (CL,SICL,SCL)			Eigenhof(EGF)	
D. LACUSTRINE CLAYS				
1. Clayey** (C,SiC,HC)***				
2. Clayey, (stratified) (C,SiC,HC)				
E. ALLUVIUM				
1. Loamy**, stratified (VFSL,L,SiL,SICL,CL)***		La Salle(LSL)		
2. Clayey, stratified (C,SiC)				
F. ORGANICS				
1. Organic (O,M)				
G. LAND UNITS				
1. Undifferentiated Unit	Shellmouth Complex(SEU)			

* St. Claude and Squirrel Creek Series are distinguished by possessing a significant layer of clay to silt-sized secondary carbonates near the surface.

** Particle Size Classes

*** Approximate corresponding textures.

Imperfectly drained				Poorly to very poorly drained		
Gleyed Regosol	Gleyed Cumulic Regosol	Gleyed Rego Black	Gleyed Black	Rego Humic Gleysol	Terric Mesisol	Typic Mesisol
Long Plain(LOP)		Almasippi(ASS)	Willowcrest(WWC)	Lelant(LLT)		
		Reinland(RLD)	Kronstal(KOT)	Osterwick(OWK)		
		Rosebank(RBK)	Elm Creek(EEK)			
		Neuenberg(NBG) St. Claude(SUE)*	Jasset(JST)			
		Gnadenthal(GDH)		Blumenfeld(BNF)		
		Grayville(GYV) Squirrel Creek(SQK)*	Rignold(RGD)	Edkins(EDK)		
		Newton Siding(NWN)				
		Neuhorst(NUH)	Rathwell(RWL)			
		Red River(RIV) Deadhorse(DHO)	Scanterbury(SCY) Plum Coulee(PME)	Osborne(OBO)		
	Gervais(GVS)			Willowbend(WWB)		
	Fortier(FTE)					
					Perillo(PER)	Xavier(XVI)

Table 2b. Key to the soils of Ecoclimatic Subregion Gt2 in the Rural Municipality of North Norfolk according to Drainage, Subgroup and Parent Material.

Drainage / Parent Material \ Subgroup	Well to moderately well drained		
	Orthic Regosol	Orthic Black	Orthic Dark Gray
A. FLUVIAL GRAVELS			
1. Sandy to Sandy-Skeletal* (S,CS) to (GrS,Gr)**			Leary(LRY)
B. EOLIAN SANDS			
1. Sandy* (FS,LFS,LS)**	Shilox(SHX)		
C. LACUSTRINE SANDS			
1. Sandy* (FS,LFS,LS)**	Arizona(AIZ)	Stockton(SCK)	Dobbin(DOB)
D. LACUSTRINE LOAMS			
1. Coarse loamy* (VFS,LVFS,FSL,SL)**		Prosser(PSE)	
2. Loamy (VFSL,L,SiL)		Fairland(FND)	Halstead(HAT)
3. Loamy over Sandy (VFSL,L,SiL) over (FS,LFS,LS)		Glenboro(GBO)	
4. Fine loamy over Sandy (CL,SICL,SCL) over (FS,LFS,LS)		Wellwood(WWD)	
5. Fine loamy (CL,SICL,SCL)		Ramada(RAM)	Firdale(FIR)
E. ORGANICS			
1. Organic (O,M)			
F. LAND UNITS			
1. Undifferentiated Units	Eroded Slopes Complex(ERX)		

* Particle Size Class

** Approximate Corresponding Textures

Imperfectly drained				Poorly to very poorly drained		
Gleyed Cumulic Regosol	Gleyed Rego Black	Gleyed Black	Gleyed Dark Gray	Rego Humic Gleysol	Terric Mesisol	Typic Mesisol
Onahan(ONH)				Mockry(MKY)		
	Hummerston(HMO)	Lavenham(LVH)		Sewell(SEE)		
	Pleasant(PLE)	Gateside(GTD)	Bone(BNE)	Poolex(POX)		
	Taggart(TGR)	Torcan(TOC)		Vordas(VDS)		
	Grover(GRO)	Petrel(PTR)				
		Oberon(OBR)				
	Prodan(PDA)	Charman(CXV)	Danlin(DLN)	Tadpole(TDP)		
					Perillo(PER)	Xavier(XVI)
				Marsh Complex(MHC)		

TABLE 3

Table 3. General Soils Legend-Key to the Soils of the Rural Municipality of North Norfolk Based on Ecoclimatic Regions, Parent Material, Soil Drainage, Taxonomic Subgroup and Series

A. Soils developed in the Grassland Transition Ecoclimatic Region, Subregions 1 and 4.

1. Soils developed on deep, weakly to moderately calcareous, sandy (FS,LFS,LS) lacustrine deposits.

a) Well Drained	
• Skelding (Orthic Regosol)	SKL
• Aronet (Cumulic Regosol)	ARN
b) Imperfectly Drained	
• Long Plain (Gleyed Regosol)	LOP
• Almasippi (Gleyed Rego Black)	ASS
• Willowcrest (Gleyed Black)	WWC
c) Poorly Drained	
• Lelant (Rego Humic Gleysol)	LLT

2. Soils developed on deep, moderately to strongly calcareous, sandy (S,CS) to sandy-skeletal (GrS,GrCS) fluvial deposits.

a) Well Drained	
• Birkenhead (Calcareous Black)	BKA

3. Soils developed on deep, moderately calcareous, coarse loamy (VFS,LVFS,FSL,SL) lacustrine deposits.

a) Imperfectly Drained	
• Reinland (Gleyed Rego Black)	RLD
• Kronstal (Gleyed Black)	KOT
b) Poorly Drained	
• Osterwick (Rego Humic Gleysol)	OWK

4. Soils developed on shallow, moderately to strongly calcareous, sandy (FS,LFS,LS) to coarse loamy (VFS,LVFS,FSL,SL), fluvial and lacustrine deposits over moderately calcareous, clayey (SiC,C) lacustrine sediments.

a) Well Drained	
• Hibsin (Orthic Black)	HIN
b) Imperfectly Drained	
• Rosebank (Gleyed Rego Black)	RBK
• Elm Creek (Gleyed Black)	EEK

5. Soils developed on shallow, moderately to strongly calcareous, loamy (VFSL,L,SiL), fluvial and lacustrine sediments over moderately calcareous, sandy (FS,LFS,LS) deposits.

a) Imperfectly Drained	
• Neuenberg (Gleyed Rego Black)	NBG
• St. Claude (Gleyed Rego Black)	SUE

- Jasset (Gleyed Black) JST

6. Soils developed on shallow, stratified, moderately to strongly calcareous, loamy (VFSL,L,SiL) lacustrine sediments grading to moderately calcareous, fine loamy (CL,SiCL,SCL) lacustrine sediments.

    a) Well Drained
    - Reinfeld (Orthic Black) RFD

    b) Imperfectly Drained
    - Gnadenthal (Gleyed Rego Black) GDH

    c) Poorly Drained
    - Blumenfeld (Rego Humic Gleysol) BNF

7. Soils developed on shallow, moderately to strongly calcareous, loamy (VFSL,L,SiL,CL,SiCL,SCL) fluvial and lacustrine sediments over moderately calcareous, clayey (SiC,C) lacustrine sediments.

    a) Well Drained
    - Denham (Orthic Black) DNH

    b) Imperfectly Drained
    - Graysville (Gleyed Rego Black) GYV
    - Squirrel Creek (Gleyed Rego Black) SQR
    - Rignold (Gleyed Black) RGD

    c) Poorly Drained
    - Edkins (Rego Humic Gleysol) EDK

8. Soils developed on deep, moderately to strongly calcareous, fine loamy (CL,SiCL,SCL), fluvial and lacustrine sediments.

    a) Well Drained
    - Eigenhof (Orthic Black) EGF

    b) Imperfectly Drained
    - Neuhorst (Gleyed Rego Black) NUH
    - Rathwell (Gleyed Black) RWL

9. Soils developed on moderately to strongly calcareous, shallow, fine loamy (CL,SiCL,SCL), fluvial and lacustrine sediments over moderately calcareous, sandy (LFS,FS,LS) deposits.

    a) Imperfectly Drained
    - Newton Siding (Gleyed Rego Black) NWN

10. Soils developed on moderately to strongly calcareous, stratified, dominantly clayey (C,SiC,SC), fluvial and lacustrine sediments.

    a) Imperfectly Drained
    - Deadhorse (Gleyed Rego Black) DHO
    - Plum Coulee (Gleyed Black) PME

11. Soils developed on fine to very fine clayey (C,SIC,HC) moderately to strongly calcareous, lacustrine sediments.

    a) Imperfectly drained

- Red River (Gleyed Rego Black) RIV
- Scanterbury (Gleyed Black) SCY

b) Poorly drained
- Osborne (Rego Humic Gleyesol) OBO

12. Soils developed on moderately to strongly calcareous, stratified, dominantly loamy (VFSL,SiL,L,SiCL,CL) recent fluvial sediments.

a) Well Drained
- La Salle (Cumulic Regosol) LSL

b) Imperfectly Drained
- Gervais (Gleyed Cumulic Regosol) GVS

c) Poorly Drained
- Willowbend (Rego Humic Gleysol) WWB

13. Soils developed on, moderately to strongly calcareous, clayey (SIC,C) recent fluvial sediments.

a) Imperfectly drained
- Fortier (Gleyed Cumulic Regosol) FTE

14. Soils developed on thin (40-160 cm), dominantly fen, moderately decomposed peat over loamy (L,SiL,VFSL) fluvial and lacustrine sediments.

a) Very Poorly Drained
- Perillo (Terric Mesisol) PER

15. Soils developed on deep (>160 cm), dominantly fen, moderately decomposed peat.

a) Very Poorly Drained
- Xavier (Typic Mesisol) XVI

16. Soils developed on sandy (S,FS,LFS) deposits to loamy (VFSL,L, SiL) moderately calcareous sediments on moderately to steeply sloping valley walls.

a) Dominantly Well to Excessively Drained
- Shellmouth Complex (dominantly Orthic Regosol) SEU

B. Soils developed in the Grassland Transition Ecoclimatic Region, Subregion 2.

1. Soils developed on deep, moderately to strongly calcareous, stratified, sandy (S,CS) and sandy-skeletal (GrS,Gr) fluvial outwash and beach deposits.

a) Well Drained
- Leary (Orthic Dark Gray) LRY

2. Soils developed on weakly to moderately calcareous, sandy (FS,LFS,LS), fluvial and lacustrine deposits.

a) Well Drained
- Arizona (Orthic Regosol) AIZ
- Stockton (Orthic Black) SCK
- Dobbin (Orthic Dark Gray) DOB

b) Imperfectly Drained

• Hummerston (Gleyed Rego Black)	HMO
• Lavenham (Gleyed Black)	LVH

c) Poorly Drained

• Sewell (Rego Humic Gleysol)	SEE

3. Soils developed on weakly to noncalcareous sandy (LFS,FS,LS) eolian deposits.

a) Well Drained

• Shilox (Orthic Regosol)	SHX

b) Imperfectly Drained

• Onahan (Gleyed Cumulic Regosol)	ONH

c) Poorly Drained

• Mockry (Rego Humic Gleysol)	MKY

4. Soils developed on moderately to strongly calcareous, coarse loamy (VFS,LVFS,FSL,SL) lacustrine deposits.

a) Well Drained

• Prosser (Orthic Black)	PSE

b) Imperfectly Drained

• Pleasant (Gleyed Rego Black)	PLE
• Gateside (Gleyed Black)	GTD
• Bone (Gleyed Dark Gray)	BNE

c) Poorly Drained

• Poolex (Rego Humic Gleysol)	POX

5. Soils developed on moderately to strongly calcareous, loamy (VFSL,L,SiL) lacustrine sediments.

a) Well Drained

• Fairland (Orthic Black)	FND
• Halstead (Orthic Dark Gray)	HAT

b) Imperfectly Drained

• Taggart (Gleyed Rego Black)	TGR
• Torcan (Gleyed Black)	TOC

c) Poorly Drained

• Vordas (Rego Humic Gleysol)	VDS

6. Soils developed on moderately to strongly calcareous, fine loamy (CL,SiCL,SCL) lacustrine sediments.

a) Well Drained

• Ramada (Orthic Black)	RAM
• Firdale (Orthic Dark Gray)	FIR

b) Imperfectly Drained

• Prodan (Gleyed Rego Black)	PDA
• Charman (Gleyed Black)	CXV
• Danlin (Gleyed Dark Gray)	DLN

c) Poorly Drained
- Tadpole (Rego Humic Gleysol) TDP

7. Soils developed on shallow, moderately to strongly calcareous, fine loamy (CL,SiCL,SCL) fluvial and lacustrine sediments over moderately calcareous, stratified sandy (FS,LFS,LS) fluvial deposits.

a) Well Drained
- Wellwood (Orthic Black) WWD

b) Imperfectly Drained
- Oberon (Gleyed Black) OBR

8. Soils developed on shallow, moderately to strongly calcareous, loamy (VFSL,L,SiL) fluvial and lacustrine sediments over moderately calcareous, stratified, sandy (FS,LFS,LS) fluvial deposits.

a) Well Drained
- Glenboro (Orthic Black) GBO

b) Imperfectly Drained
- Grover (Gleyed Rego Black) GRO
- Petrel (Gleyed Black) PTR

9. Soils developed on a complex arrangement of undifferentiated materials with a range of drainage, erosion, texture, topography and soil development characteristics adjacent to and including drainage channels.

- Eroded Slopes Complex ERX

10. Soils developed on a complex arrangement of poorly and very poorly drained, undifferentiated organic soils, mineral soils and open water in wetland area.

- Marsh Complex MHC

Almasippi Series (ASS)

The Almasippi series consists of imperfectly drained Gleyed Rego Black soil developed on moderately calcareous, uniform, sandy (FS,LFS,LS) lacustrine deposits over a lacustrine clay substrate usually within 3 meters of the surface which impedes downward water movement. These soils occur in middle to lower slope positions of level to very gentle slopes on undulating landscapes and have rapid permeability, moderately slow surface runoff, and a medium to high water table during the growing season. Almasippi soils are moderately eroded, nonstony, and occasionally saline. They have low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes trembling aspen, bur oak and tall prairie grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Almasippi soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Apk horizon, 15 to 20 cm thick, a light brownish gray AC horizon, 10 to 15 cm thick and a yellowish brown Ckgj horizon with prominent mottles. A typical profile also contains a light coloured CCa horizon below the AC horizon.

Almasippi soils occur in close association with Willowcrest, Long Plain and Lelant soils. They are similar to Willowcrest soils by having a gleyed profile developed in sands but differ from Willowcrest soils in having no Bmgj horizon. Almasippi soils were previously mapped as Calcareous Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Arizona Series (AIZ)

The Arizona series consists of moderately well to well drained Orthic Regosol soil developed on weakly to moderately calcareous, sandy (FS, LFS,LS), lacustrine and deltaic deposits. These soils occur in upper slope and knoll positions of gentle slopes on hummocky landscapes and have rapid permeability, moderate surface runoff, and a low water table during the growing season. Arizona soils are severely wind eroded, nonstony, and nonsaline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes scrub oak, black spruce and prairie grasses. The majority of these soils are currently wooded or used for natural grazing.

In a representative profile of Arizona soil there is no solum. The profile is characterized by a gray to light gray Ah horizon, 5 to 15 cm thick, and a brown to very pale brown Ck horizon with faint reddish brown mottles.

Arizona soils occur in close association with Lavenham and Stockton soils. They are similar to Shilox soils by having a Regosolic profile in sandy deposits but differ from them in having deposits of lacustrine origin while Shilox soils are eolian in origin. Arizona soils were previously mapped as eroded phases of the Stockton Association in the Carberry (1957) soil report.

Aronet Series (ARN)

The Aronet series consists of moderately well drained Cumulic Regosol soil developed on weakly to moderately calcareous, sandy (FS,LFS, LS), eolian deposits. Aronet soils are found along fence rows, adjacent to woodlots and in other areas where wind blown sand can accumulate. These soils occur in upper slope positions of gentle to moderate slopes on ridged landscapes and have rapid permeability, moderate surface runoff, and a low water table during the growing season. Aronet soils are severely eroded, nonstony, and nonsaline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes tall prairie grasses. The majority of these soils are currently in native vegetation.

In a representative profile of Aronet soil there is no soil solum. The profile is characterized by a light brown Ap horizon, 5 to 20 cm thick, with single grain structure. The profile is also characterized by a number of alternating dark brown and light brown layers. The darker layers are mostly buried Ah horizons. The overblown layers usually overlie a Chernozem like profile at depth. The parent material is typically mottled at depths of 75 cm or more.

Aronet soils occur in close association with Almasippi, Long Plain and Willowcrest soils. They are similar to Skelding soils by having no soil development but differ from them in having buried Ah horizons. Aronet soils were previously mapped as eroded inclusions of the Almasippi Association in the Carberry (1957) soil report.

Birkenhead Series (BKA)

The Birkenhead series is a Calcareous Black soil developed on moderately to strongly calcareous, stratified sandy (S,CS) and sandy skeletal (GrS,GrCS) beach deposits. These soils occur in upper positions of gentle slopes on northwest-southeast trending ridge landscapes and have rapid permeability, moderate to slow surface runoff, and a low water table during the growing season. Birkenhead soils are slightly eroded, nonstony, and nonsaline. Native vegetation includes tall prairie grasses. The majority of these soils are currently seeded to domestic grasses and legumes.

In a representative profile of Birkenhead soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 30 cm thick, a weakly calcareous, brown Bmk horizon, 10 to 20 cm thick with stratified sands and gravels, and a pale brown, strongly calcareous Ck horizon.

Birkenhead soils are similar to Leary soils by having sandy skeletal material but differ from them in having a Bmk horizon. As well, Leary soils have a dark gray surface color due to greater leaching resulting from a slightly cooler climatic area. Birkenhead soils were previously mapped as Calcareous Blackearth associates of the Agassiz Association in the Carberry (1957) soil report.

Blumenfeld Series (BNF)

The Blumenfeld series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, shallow, stratified, loamy (VFSL,L,SiL) lacustrine sediments, grading to moderately calcareous, fine loamy (CL,SiCL,SCL) lacustrine sediments. These soils occur in level to depressional positions of level slopes on level landscapes and have moderately slow permeability, very slow surface runoff, and ponding or a high water table during the growing season. Blumenfeld soils are noneroded, nonstony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, reeds, rushes and meadow grasses. The majority of these soils are currently in native vegetation.

In a representative profile of Blumenfeld soil the solum is approximately 40 cm thick. The profile is characterized by a carbonated, very dark gray Ah horizon, 25 to 40 cm thick, a thin, dark grayish brown AC horizon, 10 to 15 cm thick with prominent mottles, and a light gray Ckg horizon with prominent iron mottles. A typical profile also contains a Cca horizon of lime accumulation.

Blumenfeld soils occur in close association with Gnadenthal and Reinfeld soils. They are similar to Edkins soils by having a poorly drained profile but differ from them in having a loamy substrate while Edkins soils are clayey at depth. Blumenfeld soils were previously mapped as Calcareous Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Bone Series (BNE)

The Bone series consists of imperfectly drained Gleyed Dark Gray soil developed on weakly calcareous, deep, stratified, coarse loamy and coarse silty (VFS,LVFS,FSL,SL) lacustrine deposits. These soils occur in middle positions of very gentle to gentle slopes on hummocky landscapes and have moderately rapid permeability, moderately slow surface runoff, and a medium water table during the growing season. Bone soils are slightly eroded, nonstony, and nonsaline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain production.

In a representative profile of Bone soil the solum is approximately 90 cm thick. The profile is characterized by a dark gray to very dark gray Ah horizon, 20 to 30 cm thick, a grayish brown to brown Bmg or Bmgj horizon, 40 to 55 cm thick, a dark grayish brown Btjg or Btgj horizon, 5 to 10 cm thick, a transitional BC horizon, 5 to 10 cm thick, and a light gray, silty textured Ckgj horizon. A typical profile also contains layers of LVFS to SiL within a meter of the surface.

Bone soils occur in close association with Halstead, Gateside and Poolex soils. They are similar to Danlin soils by having a Gleyed Dark Gray profile but differ from them in having dominantly coarser textured deposits. Bone soils were previously mapped as loamy Degraded Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Charman Series (CXV)

The Charman series consists of imperfectly drained Gleyed Black soil developed on strongly to very strongly calcareous, fine loamy (CL,SiCL,SCL), lacustrine sediments. In areas of seepage or groundwater discharge, soluble salts in the subsoil can be translocated near the surface in sufficient quantities to affect crop growth. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderately slow permeability, slow surface runoff, and a medium high water table during the growing season. Charman soils are noneroded, nonstony, and frequently slightly saline. They have a moderately high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, willows, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Charman soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 15 to 25 cm thick, a dark grayish brown Bmgj horizon, 12 to 30 cm thick, a transitional BC horizon, 5 to 8 cm thick, and a pale brown, silty textured Ckgj horizon with iron mottles and frequently gypsum crystals.

Charman soils occur in close association with Ramada, Prodan and Tadpole soils. They are similar to Prodan soils by having an imperfect drainage and fine loamy sediments but differ from them in having a Bmgj horizon. Charman soils were previously mapped as Black Meadow associates of the Carroll and Holland Associations in the Carberry (1957) soil report.

Danlin Series (DLN)

The Danlin series consists of imperfectly drained Gleyed Dark Gray soil developed on moderately to strongly calcareous, fine loamy (CL,SiCL,SCL), lacustrine sediments. These soils occur in lower slope positions of very gentle to gentle slopes on rolling to undulating landscapes and have moderately slow permeability, moderate to moderately slow surface runoff, and a medium water table during the growing season. Danlin soils are noneroded, nonstony, and nonsaline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Danlin soil the solum is approximately 80 cm thick. The profile is characterized by a dark gray Ap horizon, 10 to 15 cm thick, a transitional AB horizon, 8 to 12 cm thick, a very dark grayish brown to grayish brown Btjgj horizon, 15 to 25 cm thick with faint mottles and a grayish brown Ckgj horizon with numerous faint mottles.

Danlin soils occur in close association with Firdale and Tadpole soils. They are similar to Bone soils by having a Gleyed Dark Gray profile in lacustrine sediments but differ from them in having dominantly fine loamy rather than coarse loamy sediments. Danlin soils were previously mapped as Degraded Black Meadow associates of the Firdale Association in the Carberry (1957) soil report.

Deadhorse Series (DHO)

The Deadhorse series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, deep, stratified, clayey (C,SiC,SC), fluvial and lacustrine sediments. Thin strata of silt loam to clay loam often occur within 1-2 meters of the surface. These soils occur in middle positions of level to very gentle slopes on gently undulating to level landscapes and have very slow permeability, slow surface runoff, and a high water table during the growing season. Deadhorse soils are noneroded, nonstony, and frequently slightly saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, aspen and oak. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Deadhorse soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 25 cm thick, a carbonated, dark gray to gray AC horizon, 8 to 20 cm thick and a Ckgj horizon with faint mottles.

Deadhorse soils occur in close association with Plum Coulee soils. They are similar to Plum Coulee soils by having an imperfectly drained clayey profile but differ from them in having no Bmgj horizon. Deadhorse soils were previously mapped as clayey Calcareous Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Denham Series (DNH)

The Denham series consists of moderately well to well drained Orthic Black soil developed on a mantle (60 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL,CL,SiCL, SCL), lacustrine sediments over moderately to strongly calcareous, deep, clayey (C,SiC), lacustrine sediments. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderate to moderately slow permeability overlying slowly permeable clays, moderate to moderately rapid surface runoff, and a low water table during the growing season. Denham soils are noneroded, nonstony, and nonsaline. They have medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Denham soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray to black Ap horizon, 20 to 30 cm thick, a very dark grayish brown to brown Bm horizon, 25 to 35 cm thick, a weakly calcareous BC horizon, 5 to 10 cm thick, and a yellowish brown to pale brown, moderately to strongly calcareous Ck horizon. The parent material is typically faintly mottled at depth.

Denham soils occur in close association with Rignold, Graysville and Edkins soils. They are similar to Hibsin soils by having an Orthic Black profile and clayey substrate but differ from them in having a loamy mantle rather than a coarse loamy mantle. Denham soils were previously mapped as Blackearth associates of the Rathwell Association in the Carberry (1957) soil report.

Dobbin Series (DOB)

The Dobbin series consists of well drained Orthic Dark Gray soil developed on weakly to noncalcareous, deep, sandy (LFS,FS,LS), lacustrine and eolian deposits. These soils occur in middle and upper positions of gentle slopes on undulating to hummocky landscapes and have rapid permeability, rapid surface runoff, and a low water table during the growing season. Dobbin soils are slightly wind eroded, nonstony, and nonsaline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen groves, bur oak, shrubs and tall prairie grasses. The majority of these soils are currently utilized for forage and crop production.

In a representative profile of Dobbin soil the solum is approximately 90 cm thick. The profile is characterized by a gray to dark gray Ap horizon, 20 to 35 cm thick, a grayish brown to brown Bm horizon, 40 to 55 cm thick, a dark grayish brown Btj or Bt horizon, 5 to 10 cm thick with slight clay accumulation and a transitional BC horizon, 15 to 20 cm thick. A typical profile also contains thin strata of VFSL to SiL textures.

Dobbin soils occur in close association with Stockton, Lavenham and Sewell soils. They are similar to Halstead soils by having a well drained Dark Gray profile but differ from them in having sandy rather than coarse loamy deposits. Dobbin soils were previously mapped as Degraded Black associates of the Stockton Association in the Carberry (1957) soil report.

Edkins Series (EDK)

The Edkins series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (40 to 60 cm) of moderately to strongly calcareous, shallow loamy (VFSL,L, SiL,SiCL,CL,SCL), lacustrine sediments over moderately to strongly calcareous, clayey (C,SiC) lacustrine sediments. These soils occur in level to depressional positions of nearly level slopes on level landscapes and have restricted permeability, slow surface runoff, and a high water table during the growing season. Edkins soils are noneroded, nonstony, and frequently slightly saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, willows and reeds. The majority of these soils are currently under native vegetation.

In a representative profile of Edkins soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray, calcareous Ahk horizon, 15 to 30 cm thick, a light gray AC horizon, 8 to 20 cm thick, usually a Cca horizon, 5 to 10 cm thick with lime accumulation and a calcareous Ckg horizon with mottles and gypsum crystals.

Edkins soils occur in close association with Denham, Graysville and Rignold soils. They are similar to Blumenfeld soils by having poor drainage and a loamy surface mantle but differ from them in having a clayey substrate rather than a fine loamy substrate. Edkins soils were previously mapped as Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Eigenhof Series (EGF)

The Eigenhof series consists of moderately well to well drained Orthic Black soil developed on moderately to strongly calcareous, deep, stratified, fine loamy (CL,SiCL,SCL), lacustrine sediments. These soils occur in upper positions of nearly level to very gentle slopes on undulating landscapes and have moderate to moderately slow permeability, moderate surface runoff, and a low water table during the growing season. Eigenhof soils are noneroded, nonstony and nonsaline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen-oak groves, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Eigenhof soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 15 to 25 cm thick, a grayish brown Bm horizon, 15 to 20 cm thick, a weakly calcareous, transitional BC horizon 5 to 15 cm thick, and a moderately calcareous Ck horizon with stratified SiL and SiCL textures. A typical profile also contains thin layers of fine sand to silt below the solum.

Eigenhof soils occur in close association with Neuhorst soils. They are similar to Denham soils by having an Orthic Black profile but differ from them in having no clayey substrate diagnostic of Denham soils. Eigenhof soils were previously mapped as Blackearth associates of the Rathwell Association in the Carberry (1957) soils report.

Elm Creek Series (EEK)

The Elm Creek series consists of imperfectly drained Gleyed Black soil developed on a mantle (50 to 80 cm) of moderately to strongly calcareous, shallow, sandy (FS,LFS,LS) to coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits over moderately calcareous, deep, uniform, clayey (SiC,C), lacustrine sediments. These soils occur in middle positions of very gentle slopes on level to undulating landscapes and have rapid over restricted permeability, slow surface runoff, and a high water table during the growing season. Elm Creek soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, aspen-oak groves, and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Elm Creek soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray to dark gray Ah horizon, 18 to 25 cm thick, a grayish brown to dark grayish brown Bmgj horizon, 25 to 40 cm thick with many distinct mottles, frequently a Cca horizon, 10 to 15 cm thick, and a brownish gray to gray IICkgj horizon with distinct yellowish brown mottles.

Elm Creek soils occur in close association with Hibsin and Rosebank soils. They are similar to Rosebank soils by having an imperfectly drained profile in coarse loamy deposits over clayey sediments but differ from them in having a Bmgj horizon. Elm Creek soils were previously mapped as Black Meadow associates of the Almasippi, clay substrate phase, Association in the Carberry (1957) soil report.

Eroded Slope Complex (ERX)

This soil complex includes all the land occupied by the eroded slopes of river valleys and walls, incised stream channels and ravines that have down-cut through the surface deposits and shale bedrock. These are generally well drained, strongly to steeply sloping landforms that have variable soil development on materials that are variable in composition, depending on the nature of the surrounding deposits. Due to its complexity, this is a miscellaneous land type rather than a unit of normal soil. These areas are typically influenced by mass wasting processes such as slump, creep, solifluction and erosion.

In the study area the soils range from Orthic Blacks to Regosols. The soil parent materials are mainly deep lacustrine, fluvial and eolian which are subsequently deposited as colluvium along the slopes. The slopes are characterized by numerous major seepage zones where the water table intersects the slope walls or scarps, generally in the mid to lower slopes. The maintenance of vegetation on the Eroded Slopes is essential for their stability.

Fairland Series (FND)

The Fairland series consists of moderately well to well drained Orthic Black soil developed on strongly to very strongly calcareous, deep, stratified, loamy (VFSL,L,SiL), lacustrine sediments. These soils occur in upper positions of gentle slopes on rolling landscapes and have moderate permeability, moderate surface runoff, and a low water table during the growing season. Fairland soils are often slightly eroded, and usually nonstony, and nonsaline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation in- cludes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Fairland soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ap horizon, 10 to 15 cm thick, a brown to dark brown Bm horizon, 10 to 15 cm thick, a pale brown BC horizon, 5 to 10 cm thick with carbonates and a light gray Cca horizon, 5 to 10 cm thick, with lime accumulation. The parent material is typically very pale brown and calcareous.

Fairland soils occur in close association with Torcan, Taggart and Vordas soils. They are similar to Torcan soils by having a well developed profile in loamy sediments but differ from them in having a strongly developed Bm horizon lacking gleying. Fairland soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Firdale Series (FIR)

The Firdale series consists of moderately well to well drained Orthic Dark Gray soil developed on moderately to strongly calcareous, deep, fine loamy (CL,SiCL,SCL), lacustrine sediments. These soils occur in upper positions of gentle to moderate slopes on undulating and dissected landscapes and have moderate to moderately slow permeability, moderate to rapid surface runoff, and a low water table during the growing season. Firdale soils are often moderately eroded, nonstony, and nonsaline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Firdale soil the solum is approximately 60 cm thick. The profile is characterized by a dark gray Ap horizon, 20 to 30 cm thick, a yellowish Bt horizon, 30 to 45 cm thick with clay accumulation, a Cca horizon, 5 to 10 cm thick, and a calcareous Ck horizon.

Firdale soils occur in close association with Danlin and Tadpole soils. They are similar to Halstead soils by having a well drained Orthic Dark Gray profile but differ from them in having fine loamy rather than coarse loamy deposits. Firdale soils were previously mapped as Degraded Black associates of the Firdale Association in the Carberry (1957) soil report.

Fortier Series (FTE)

The Fortier series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on moderately to strongly calcareous, clayey (SIC,C) fluvial sediments. These soils occur in smooth, level positions of very gentle slopes on flood prone terraces and meander landscapes, have slow permeability, slow surface runoff, and a high water table especially during spring season. Fortier soils are noneroded, nonstony and often moderately saline. They have a high available water holding capacity, low organic matter content and low natural fertility. The native vegetation comprises tall prairie and prairie meadow grass with some deciduous trees. The majority of these soils are currently under cultivation.

In a representative profile of Fortier soil the solum is very weakly developed. The profile is characterized by a weak dark gray to gray Ah horizon, 10 to 20 cm thick which is slightly darker in colour than the underlying mottled Ckgj horizon. Thin layers of VFSL, SiL and SiCL are often present in the dominantly clayey profile. Buried AH horizons occur in the profile as well.

Fortier soils occur in association with Willowbend, Gervais and LaSalle soils. They are similar to Gervais soils by having stratified layers of variable texture and organic matter content and imperfect drainage but differ from them by having a dominantly clayey texture. Fortier soils were previously mapped as imperfectly drained immature associates of the Oakville Association in the Carberry (1957) soil report.

Gateside Series (GTD)

The Gateside series consists of imperfectly drained Gleyed Black soil developed on moderately to strongly calcareous, deep, coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits. These soils occur in middle positions of very gentle to nearly level slopes on undulating landscapes and have moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Gateside soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, aspen-oak groves, shrubs and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Gateside soil the solum is approximately 35 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 12 to 18 cm thick, a brown to olive brown Bmgj horizon, 15 to 30 cm thick with faint iron mottles, a light olive brown BC horizon, 5 to 15 cm thick with carbonates and a light olive brown to yellowish brown Ckgj horizon with distinct yellowish brown mottles.

Gateside soils occur in close association with Prosser, Pleasant and Poolex soils. They are similar to Pleasant soils by having imperfect drainage in coarse loamy deposits but differ from them in having a Bmgj horizon. Gateside soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Gervais Series (GVS)

The Gervais series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on moderately to strongly calcareous, deep, stratified, loamy (VFSL,SiL,L,SiCL,CL), recent fluvial sediments. Flooding is a hazard where drainage has not been improved. These soils occur in middle positions of very gentle slopes on floodplain landscapes and have moderately slow to slow permeability, slow surface runoff, and a high water table during the growing season. Gervais soils are noneroded, nonstony, and frequently slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes elm, maple, poplar and meadow grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Gervais soil there is only very weak development. The profile is characterized by a weakly developed dark gray to gray Ah horizon, 12 to 20 cm thick, and a lighter colored Ckgj horizon, with stratified FSL and FS textured layers. A typical profile also contains dark coloured buried Ah horizons.

Gervais soils occur in close association with La Salle and Willowbend soils. They are similar to La Salle soils by having stratified layers of variable texture and organic matter content in loamy sediments but differ from La Salle soils because of imperfect drainage. Gervais soils were previously mapped as immature associates of the Riverdale Association in the Carberry (1957) soil report.

Glenboro Series (GBO)

The Glenboro series consists of moderately well to well drained Orthic Black soil developed on a mantle (25 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), lacustrine sediments over moderately calcareous, stratified, deep, sandy (FS,LFS,LS) deposits. These soils occur in upper positions of gentle slopes on sloping to undulating landscapes and have moderate surface permeability increasing to moderately rapid permeability with depth, moderately slow surface runoff, and a low water table during the growing season. Glenboro soils are nonstony, nonsaline and often slightly eroded. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Glenboro soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 12 to 18 cm thick, with granular structure, a dark brown to brown Bm or Btj horizon, 10 to 16 cm thick with subangular blocky structure, a brown to pale brown BC horizon, 6 to 14 cm thick and a light gray to very pale brown Cca horizon 5 to 8 cm thick. The parent material is typically a pale brown to light yellowish brown sandy textured Ck horizon. Some stratified sands to loams may occur in the loam/sand transition.

Glenboro soils occur in close association with Grover and Petrel soils. They are similar to Fairland soils by having an Orthic Black profile and loamy surface mantle but differ from them in having a sandy substrate. Glenboro soils were previously mapped as Blackearth associates of the Glenboro Association in the Carberry (1957) soil report.

Gnadenthal Series (GDH)

The Gnadenthal series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, shallow, stratified,loamy (VFSL,L,SiL), lacustrine sediments grading to moderately calcareous, fine loamy (CL,SiCL,SCL) lacustrine sediments. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderate permeability, moderately slow surface runoff, and a medium water table during the growing season. Gnadenthal soils are noneroded, nonstony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Gnadenthal soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black weakly calcareous Apk horizon, 15 to 40 cm thick, a gray to dark gray AC horizon, 7 to 25 cm thick with moderate calcareousness, occasionally a Cca horizon, 5 to 10 cm thick with lime accumulation and a Ckgj horizon with iron mottles. The parent material is typically stratified with FSL,SiCL and CL textures.

Gnadenthal soils occur in close association with Reinfeld and Blumenfeld soils. They are similar to Neuenberg soils by having a Gleyed Rego Black profile and loamy surface but differ from them in having a finer textured subsurface. Gnadenthal soils were previously mapped as Calcareous Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Graysville Series (GYV)

The Graysville series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 90 cm) of moderately to strongly calca- reous, loamy, (VFSL,L,SiL,CL,SiCL, SCL) fluvial and lacustrine sediments over moderately calcareous, clayey (C,SIC), lacustrine sediments. These soils occur in middle positions of nearly level slopes on undulating landscapes with slow surface runoff. Permeability is moderate in the loamy overlay and very slow in the clayey substrate. They have a perched water table during the spring and early growing season. Graysville soils are noneroded, nonstony, and occasionally slightly saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie grasses and willows. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Graysville soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 40 cm thick, an AC horizon, 8 to 20 cm thick with moderate calcareousness, occasionally a Cca horizon, 5 to 8 cm thick and a IICkgj horizon with many distinct mottles. A typical profile also contains gypsum in the lower Ckgj horizon.

Graysville soils occur in close association with Denham, Rignold and Edkins soils. They are similar to Rignold soils by having the same drainage and materials but differ from them in having no diagnostic Bmgj horizon. Graysville soils were previously mapped as Calcareous Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Grover Series (GRO)

The Grover series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), lacustrine sediments over moderately calcareous, deep, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate surface permeability increasing to moderately rapid permeability with depth, moderately slow surface runoff, and a high water table during the growing season. Grover soils are noneroded, nonstony, and nonsaline. They have medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, ash and tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Grover soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to black Ah or Ahk horizon, 15 to 25 cm thick, a dark grayish brown AC horizon, 15 to 20 cm thick with faint mottles, a Cca horizon, 5 to 8 cm thick, and a light yellowish brown sandy Ckgj horizon with yellowish brown mottles.

Grover soils occur in close association with Glenboro and Petrel soils. They are similar to Petrel soils by having an imperfectly drained profile with a sandy substrate but differ from them in having a transitional AC horizon as opposed to a Bmgj horizon in Petrel soils. Grover soils were previously mapped as Calcareous Black Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Halstead Series (HAT)

The Halstead series consists of well to moderately well drained Orthic Dark Gray soil developed on weakly calcareous, deep, stratified, loamy (VFSL,L,SiL), lacustrine sediments. These soils occur in upper positions of very gentle to gentle slopes on hummocky landscapes and have moderate to moderately rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Halstead soils are frequently moderately eroded, usually nonstony and nonsaline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, scrub oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Halstead soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 20 to 30 cm thick, a weakly developed brown Bm horizon, 15 to 25 cm thick, a prominent brown Bt horizon, 5 to 10 cm thick and a brown Ck or Ckgj horizon. A typical profile also contains thin layers of SiCL and SiL textures.

Halstead soils occur in close association with Bone and Poolex soils. They are similar to Firdale soils by having an Orthic Dark Gray profile but differ from them in having loamy rather than fine loamy sediments. Halstead soils were previously mapped as Degraded Black associates of the Firdale Association in the Carberry (1957) soil report.

Hibsin Series (HIN)

The Hibsin series consists of moderately well drained Orthic Black soil developed on a mantle (40 to 90 cm) of moderately to strongly calcareous, shallow, sandy (FS,LFS,LS) to coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine sediments. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderately rapid surface permeability decreasing to slow permeability with depth, moderate surface runoff, and a low water table during the growing season. Hibsin soils are noneroded, nonstony, and nonsaline. They have a medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Hibsin soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray to dark gray Ah horizon, 15 to 25 cm thick, a brown Bm horizon, 20 to 30 cm thick, a Cca horizon, 8 to 13 cm thick with lime accumulation and a Ck horizon. The profile is usually developed entirely in the coarser material.

Hibsin soils occur in close association with Rosebank and Elm Creek soils. They are similar to Elm Creek soils by having a B horizon in coarse loamy deposits but differ from them in lacking mottles in the Bm horizon. Hibsin soils were previously mapped as Blackearth associates of the Almasippi, clay substrate phase, Association in the Carberry (1957) soil report.

Hummerston Series (HMO)

The Hummerston series consists of imperfectly drained Gleyed Rego Black soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine and fluvial deposits. These soils occur in middle to lower positions of very gentle slopes on undulating landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Hummerston soils are slightly wind eroded, nonstony, and slightly saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen-oak groves, shrubs, tall prairie and meadow grasses. The majority of these soils are currently cultivated for forage and grain crops.

In a representative profile of Hummerston soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 20 cm thick, a dark gray AC horizon, 10 to 18 cm thick with moderate calcareousness, and a yellowish brown Ckgj horizon with prominent yellow mottles.

Hummerston soils occur in close association with Stockton, Lavenham and Sewell soils. They are similar to Lavenham soils by having an imperfectly drained profile in sandy deposits but differ from them in having no diagnostic Bmgj horizon. Hummerston soils were previously mapped as Calcareous Black Meadow associates of the Stockton Association in the Carberry (1957) soil report.

Jasset Series (JST)

The Jasset series consists of imperfectly drained Gleyed Black soil developed on a mantle (70 to 90 cm) of moderately to strongly calcareous, shallow loamy (VFSL,L,SiL), lacustrine sediments over moderately calcareous, stratified, deep, sandy (FS,LFS,VFS) lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate permeability increasing to moderately rapid permeability with depth, slow surface runoff, and a high water table during the growing season. Jasset soils are noneroded, nonstony, and occasionally slightly saline. They have medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, maple and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of a Jasset soil the solum is approximately 60 cm thick. The profile is characterized by a very dark gray to black Ap horizon, 25 to 35 cm thick, a brown to yellowish brown Bmgj horizon, 25 to 40 cm thick with fine, faint mottles, a carbonated BC horizon, 10 to 15 cm thick and a Cca horizon, 5 to 10 cm thick. A typical profile also contains a calcareous Ckgj horizon with prominent mottles.

Jasset soils occur in close association with Neuenberg and St. Claude soils. They are similar to Neuenberg soils by having an imperfectly drained profile in loamy over sandy deposits, but differ from them in having a prominent Bmgj horizon. Jasset soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Kronstal Series (KOT)

The Kronstal series consists of an imperfectly drained Gleyed Black soil developed on moderately calcareous, deep, stratified, coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits. These soils occur in middle positions of nearly level slopes on undulating landscapes and have moderate to moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Kronstal soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen-oak groves, shrubs, meadow and tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of a Kronstal soil the solum is approximately 55 cm thick. The profile is characterized by a very dark gray Ah horizon, 20 to 30 cm thick, a grayish brown to brown Bmgj horizon, 20 to 40 cm thick with fine to medium yellowish mottles, a Cca horizon, 8 to 13 cm thick and a Ckgj horizon with distinct mottles. The parent material is typically stratified with layers of FS to LFS texture.

Kronstal soils occur in close association with Reinland and Osterwick soils. They are similar to Jasset soils by having a Gleyed Black profile and coarse loamy substrate but differ from them in having no loamy surface mantle. Kronstal soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

La Salle Series (LSL)

The La Salle series consists of moderately well drained Cumulic Regosol soil developed on moderately to strongly calcareous, deep, stratified, loamy (VFSL,SiL,L,SiCL,CL), recent alluvial sediments. These soils occur in upper positions of gentle slopes on meander scrolls and levee landscapes, have moderate permeability, moderate surface runoff, and a low water table during the growing season. La Salle soils are slightly eroded, nonstony, and non- saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes elm, ash, basswood and maple. The majority of these soils are currently cultivated for forage and grain crops.

In a representative profile of La Salle soil the solum is very weakly developed. The profile is characterized by a weakly developed, dark gray Ah horizon, 5 to 15 cm thick, and a grayish brown Ck horizon with strata of (Sil,SiCL,VFS and FS) textures.

La Salle soils occur in close association with Gervais and Willowbend soils. They are similar to Gervais soils by having stratified layers of variable texture and organic matter content on loamy alluvium but differ from them in lacking mottles within the profile. La Salle soils were previously mapped as well drained associates of the Riverdale Association in the Carberry (1957) soil report.

Lavenham Series (LVH)

The Lavenham series consists of imperfectly drained Gleyed Black soil developed on weakly to moderately calcareous, uniform, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in middle to lower positions of very gentle slopes on undulating landscapes, have moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Lavenham soils are often slightly wind eroded, nonstony, and slightly saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen-oak groves, shrubs, tall prairie and meadow grasses. The majority of these soils are currently cultivated for forage and grain crops.

In a representative profile of Lavenham soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray to very dark brown Ah horizon, 18 to 25 cm thick, a dark brown to yellowish brown Bmgj horizon, 20 to 40 cm thick with distinct brown mottles in the lower part of the horizon, a lime carbonate accumulation (Ccagj) horizon, 12 to 20 cm thick, and a pale brown Ckgj horizon with distinct to prominent brown mottles.

Lavenham soils occur in close association with Stockton, Hummerston and Sewell soils. They are similar to Hummerston soils by having a gleyed profile and sandy texture but differ from them because of a prominent Bmgj horizon. Lavenham soils were previously mapped as Black Meadow Associates of the Stockton Association in the Carberry (1957) soil report.

Leary Series (LRY)

The Leary series consists of well to rapidly drained Orthic Dark Gray soil developed on moderately to strongly calcareous, deep, stratified, sandy (S,CS) to sandy-skeletal (GrS, Gr), glaciofluvial deposits. These soils occur in middle to upper slope positions of moderate slopes on hummocky landscapes and have very rapid permeability, moderate surface runoff and a low water table during the growing season. Leary soils are often slightly eroded, slightly stony and nonsaline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation often includes forests of dominantly burr oak. The majority of these soils are currently excavated for road construction and the aggregate industry.

In a representative profile of Leary soil the solum is approximately 50 cm thick. The profile is characterized by a dark gray Ah or Ap horizon, 10 to 20 cm thick, a dark brown Bt or Btj horizon, 5 to 20 cm thick, a brown transitional BC horizon, 15 to 30 cm thick and a light yellowish brown Ck horizon with thin layers of coarse sand, fine sand and gravel.

Leary soils are similar to Dobbin soils by having an Orthic Dark Gray soil profile but differ from Dobbin soils by having a sandy-skeletal substrate material as opposed to a sandy textured material. Leary soils were previously mapped as the Degraded Black associates of the Agassiz Association in the Carberry (1957) soil report.

Lelant Series (LLT)

The Lelant series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in level to depressional positions of very gently sloping back beach landscapes and have rapid but restricted permeability, very slow surface runoff, and a high water table during the growing season. Lelant soils are noneroded, nonstony, and frequently slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes reeds, sedges, rushes and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Lelant soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 5 to 10 cm thick, a very dark gray to black Ah horizon, 8 to 15 cm thick, a transitional AC horizon, 5 to 10 cm thick, and a Cca horizon, 5 to 8 cm thick is frequently present.

Lelant soils occur in close association with Skelding, Long Plain and Almasippi soils. They are similar to Osterwick soils by having a poorly drained Rego Humic Gleysol profile but differ from them in having sandy rather than coarse loamy deposits. Lelant soils were previously mapped as Meadow associates of the Almasippi in the Carberry (1957) soil report.

Long Plain Series (LOP)

The Long Plain series consists of imperfectly drained Gleyed Regosol soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), wind-modified, deltaic deposits. These soils occur in middle positions of gentle slopes on undulating landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Long Plain soils are severely wind eroded, nonstony, and nonsaline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes scrub oak, aspen, shrubs and prairie grasses. The majority of these soils are currently used for pasture.

In a representative profile of Long Plain soil the solum is very weakly developed. The profile is characterized by a dark gray to gray Ap horizon, 10 to 25 cm thick, a leached Cgj horizon, 60 to 90 cm thick, and a calcareous Ckgj horizon with prominent mottles. A typical profile also contains a dark gray Cca layer, 5 to 15 cm thick, within a meter of the surface.

Long Plain soils occur in close association with Willowcrest, Almasippi and Lelant soils. They are similar to Willowcrest soils by having an imperfectly drained profile in sandy deposits but differ from them in lacking a dark coloured A horizon. Long Plain soils were previously mapped as associates of the Almasippi Association in the Carberry (1957) soil report.

Marsh Complex (MHC)

The Marsh complex consists of very poorly drained, Rego Gleysol soils developed on lacustrine clay or thin mucky loam sediments over extremely calcareous till and/or moderately calcareous clay. These soils occur on level to depressional areas that are covered with water and are usually saturated for most of the year. The native vegetation consists entirely of reeds and sedges.

These soils have a thin surface layer of either muck or mineral material high in organic matter content and are underlain by strongly gleyed olive gray mineral materials. A very thin Ahg horizon, less than 2.5 cm thick, may be present below the muck surface layer.

Marsh soils are undifferentiated with respect to texture and composition of their parent material. They also are much more poorly drained than other Gleysolic soils. Marsh soils were previously mapped as very poorly drained undifferentiated muck and peat soils in the Carberry (1957) report.

Mockry Series (MKY)

The Mockry series consists of poorly drained Rego Humic Gleysol soil developed on weakly to noncalcareous, stratified, deep, sandy (FS,LFS,LS), eolian deposits. These soils occur in depressional positions on hummocky landscapes and have rapid permeability, slow surface runoff, and a high water table during the growing season. Mockry soils are noneroded, nonstony, and often slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes rushes, sedges, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Mockry soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 20 cm thick, an olive gray AC horizon, 10 to 15 cm thick with moderate calcareousness and frequently a Cca horizon, 5 to 8 cm thick. The parent material is typically olive gray and mottled.

Mockry soils occur in close association with Shilox and Onahan soils. They are similar to Sewell soils by having a poorly drained profile in sandy deposits but differ from them in developing on deposits of eolian rather than lacustrine origin. Mockry soils were previously mapped as Meadow associates of the Stockton Association in the Carberry (1957) soil report.

Neuenberg Series (NBG)

The Neuenberg series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (70 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L, SiL), fluvial and lacustrine sediments over moderately calcareous, stratified, deep, coarser textured (FS,LFS,LS), lacustrine deposits. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderate surface permeability grading to rapid permeability with depth, moderate to moderately slow surface runoff, and a high water table during the growing season. Neuenberg soils are noneroded, nonstony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of a Neuenberg soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ahk horizon, 15 to 25 cm thick, with moderate calcareousness, an AC horizon, 10 to 20 cm thick, frequently a Cca horizon, 5 to 8 cm thick, and a Ckgj horizon with many distinct mottles. A typical profile contains VFSL,L textures grading to VFS and FS with depth.

Neuenberg soils occur in close association with St. Claude and Jasset soils. They are similar to Gnadenthal soils by having a Gleyed Rego Black profile and loamy surface mantle but differ from them in having coarser textures rather than finer textures at depth. Neuenberg soils were previously mapped as Calcareous Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Neuhorst Series (NUH)

The Neuhorst series consists of imperfectly drained Gleyed Rego Black soil developed on moderately calcareous, deep, uniform, fine loamy (CL,SiCL,SCL), fluvial and lacustrine sediments. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderately slow to slow permeability, slow surface runoff, and a medium water table during the growing season. Neuhorst soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, prairie-meadow grasses and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Neuhorst soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ahk horizon, 25 to 40 cm thick, with weak calcareousness, a dark gray to gray AC horizon, 8 to 20 cm thick, frequently a light gray Cca horizon, 10 to 15 cm thick with lime accumulation and a light gray to pale yellow Ckgj horizon with many distinct mottles. A typical profile also contains gypsum crystals below the AC or Cca horizon.

Neuhorst soils occur in close association with Eigenhof soils. They are similar to Newton Siding soils by having a Gleyed Rego Black profile and fine loamy surface but differ from them in having no sandy substrate. Neuhorst soils were previously mapped as Calcareous Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Newton Siding Series (NWN)

The Newton Siding series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (40 to 90 cm) of moderately to strongly calcareous, shallow fine loamy (CL,SiCL,SCL), fluvial and lacustrine sediments over moderately calcareous, stratified, deep, sandy (FS,LFS,LS), fluvial and lacustrine deposits. These soils occur in middle positions of nearly level slopes on undulating landscapes and have moderately slow surface permeability grading to moderately rapid permeability with depth, slow surface runoff, and a high water table during the growing season. Newton Siding soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie-meadow grasses, shrubs and tall-prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Newton Siding soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 25 to 40 cm thick, with weak calcareousness, a gray AC horizon, 8 to 20 cm thick with moderate calcareousness, a Ccagj horizon, 10 to 15 cm thick is often present, and a IICkgj horizon, with prominent mottles.

Newton Siding soils occur in close association with Neuhorst soils. They are similar to Neuhorst soils by having an imperfectly drained profile developed in fine loamy sediments but differ from them in having a sandy substrate. Newton Siding soils were previously mapped as Calcareous Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Oberon Series (OBR)

The Oberon series consists of imperfectly drained Gleyed Black soil developed on a mantle (25 to 75 cm) of strongly calcareous, shallow, uniform, fine loamy (CL,SiCL,SCL), lacustrine sediments over moderately calcareous, deep, uniform, sandy (FS,LFS,LS), glaciofluvial deposits. These soils occur in mid to lower positions of gentle to very gentle slopes on undulating to hummocky landscapes and have moderate surface permeability grading to rapid permeability with depth, moderate to moderately slow surface runoff, and a low water table during the growing season. Oberon soils are occasionally slightly eroded, nonstony, and may be slightly saline. They have a medium available water holding capacity, medium organic matter content and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Oberon soil the solum is approximately 40 cm thick. The profile is characterized by a black to very dark gray Ah horizon, 18 to 25 cm thick, a subangular blocky brown to olive brown Bmgj horizon 12 to 22 cm thick with yellowish brown mottles, and a BC horizon, 8 to 16 cm thick. A lime accumulation (Cca) is usually present within the loamy strata. The (IICkgj) sandy substrata is light yellowish brown with yellowish brown to strong brown iron mottles.

Oberon soils occur in close association with Wellwood soils. They are similar to Petrel soils by having a Gleyed Black profile and sandy substrate but differ from them in having a fine loamy rather than loamy surface. Oberon soils were previously mapped as Black Meadow associates of the Wellwood Association in the Carberry (1957) soil report.

Onahan Series (ONH)

The Onahan series consists of imperfectly drained Gleyed Regosol soil developed on weakly to noncalcareous, deep, sandy (FS,LFS,LS), eolian deposits. The surfaces of these soils have been stabilized for over 60 years as indicated by tree growth. They occur in lower or middle positions of moderate to strong slopes on hummocky duned landscapes and have rapid permeability, slow surface runoff, and a medium water table during the growing season. Onahan soils are wind eroded, nonstony, and nonsaline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen, oak, black spruce and meadow grasses. The majority of these soils are currently used for natural grazing.

In a representative profile of Onahan soil there is only very minimal solum development. The profile is characterized by a partially decomposed LH horizon, 1 to 3 cm thick, a gray to dark gray Ah horizon, 5 to 18 cm thick, and a pale brown Cgj horizon, with strong brown to yellowish brown mottles.

Onahan soils occur in close association with Shilox and Mockry soils. They are similar to Hummerston soils by having sandy deposits and imperfect drainage but differ from them in having no Chernozemic A horizon. Onahan soils were previously mapped as immature associates of the Stockton Association in the Carberry (1957) soil report.

Osborne Series (OBO)

The Osborne series consists of poorly drained Rego Humic Gleysol soils developed on moderately to strongly calcareous, deep uniform, clayey, (C,SiC,HC) lacustrine sediments. These soils occur in level to depressional positions of level landscapes and have very slow permeability, slow to very slow surface runoff and a high water table during the growing season. Osborne soils are noneroded, nonstony and often slightly saline. They have high available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes meadow grasses, reeds, sedges and willow. The majority of these soils are currently used for crop production and have improved drainage.

In a representative profile of Osborne soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray, noncalcareous, clay, Ap horizon, 15 to 20 cm thick, with a thin transitional dark gray to olive gray weakly calcareous AC horizon, 8 to 10 cm thick and an olive gray, moderately to strongly calcareous, clayey, mottled Ckg horizon.

Osborne soils occur in close association with Red River and Scanterbury soils. They are similar to these soils by having developed on clayey parent material but differ because of poorer drainage. Osborne soils were previously mapped as Meadow associates of the Red River Association in the Carberry (1957) soil report.

Osterwick Series (OWK)

The Osterwick series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS,LVFS,FSL,SL) deposits. These soils occur in depressional positions of level landscapes and have moderately rapid permeability, very slow surface runoff, and a high to ponded water table during the growing season. Osterwick soils are noneroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes meadow grasses, sedges, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Osterwick soil the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed Om horizon, 6 to 12 cm thick, a very dark gray Ah horizon, 15 to 25 cm thick, a light gray AC horizon, 5 to 10 cm thick and a gray Ckg horizon with yellowish brown mottles. A typical profile also contains a Cca horizon below the AC horizon.

Osterwick soils occur in close association with Kronstal and Reinland soils. They are similar to Lelant soils by having a poorly drained profile in sand textured deposits but differ from them in having dominantly VFS rather than FS textures. Osterwick soils were previously mapped as Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Perillo Series (PER)

The Perillo series consists of very poorly drained Terric Mesisol soil developed on a mantle (40 to 160 cm) of moderately decomposed organic, material composed of fen peat over moderately to strongly calcareous, deep, uniform, loamy (L, SiL, VFSL), lacustrine sediments. These soils occur in depressional positions of nearly level slopes on rolling to hummocky landscapes and have slow permeability, very slow surface runoff and a very high water table during the growing season. Perillo soils are occasionally slightly saline. They have a high available water holding capacity, very high organic matter content, and low natural fertility. Native vegetation often includes sedges, reeds, and clumps of willow or swamp birch. The majority of these soils are currently used for natural grazing.

In a representative profile of Perillo soil the solum is approximately 50 cm thick. The profile is characterized by a black Om horizon, 5 to 15 cm thick, a black Oh horizon, 20 to 45 cm thick, a black Ah horizon, 15 to 25 cm thick, with a few large iron mottles and a light brownish gray AC horizon 10 to 25 cm thick with many large prominent iron mottles. The mineral soil parent material is typically light gray in color with numerous prominent mottles and manganese concretions. A typical profile also contains snail shells on the surface and throughout the profile.

Perillo soils occur in association with sloughs, lakes and areas of restricted drainage. They are similar to Tadpole peaty phase soils but differ from them in having an organic surface horizon greater than 40 cm thick to the mineral soil substrate. Perillo soils were previously mapped as peaty meadow or marsh inclusions of many soil associations but dominantly the Stockton and Almasippi Associations in the reconnaissance soil survey of Carberry (1957).

Petrel Series (PTR)

The Petrel series consists of imperfectly drained Gleyed Black soil developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), sediments over moderately calcareous, uniform, deep, sandy (FS,LFS,LS), lacustrine and fluvial deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate surface permeability increasing to moderately rapid permeability with depth, moderately slow surface runoff, and a high water table during the growing season. Petrel soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, shrubs, aspen and oak. The majority of these soils are currently cultivated for crop production.

In a representative profile of Petrel soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a brown Bmgj horizon, 14 to 20 cm thick, a BC horizon, 20 to 30 cm thick with faint mottles and a light yellowish brown Ckgj horizon with yellowish brown to strong brown mottles. A typical profile also contains a weak Cca in the upper part of the sandy substrate.

Petrel soils occur in close association with Glenboro and Grover soils. They are similar to Torcan soils by having imperfect drainage and a loamy surface but differ from them in having a sandy substrate. Petrel soils were previously mapped as Black Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Pleasant Series (PLE)

The Pleasant series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS,LVFS,FSL,SL), lacustrine and fluvial deposits. These soils occur in middle positions of gentle slopes on irregular to undulating landscapes and have moderate permeability, moderately slow surface runoff, and a high water table during the growing season. Pleasant soils are noneroded, nonstony, and frequently slightly saline. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, prairie-meadow grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Pleasant soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 25 cm thick, a dark grayish brown AC horizon, 6 to 10 cm thick, a Cca horizon, 10 to 15 cm thick and a light olive brown Ckgj horizon with yellowish brown mottles. A typical profile also contains gypsum crystals below the Cca horizon.

Pleasant soils occur in close association with Prosser, Gateside and Poolex soils. They are similar to Taggart soils by having an imperfectly drained Gleyed Rego Black profile but differ from them in having coarse loamy rather than loamy deposits. Pleasant soils were previously mapped as Calcareous Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Plum Coulee Series (PME)

The Plum Coulee series consists of imperfectly drained Gleyed Black soil developed on moderately calcareous, stratified, deep, clayey (C,SiC,SC), fluvial and lacustrine sediments. These soils occur in middle positions of nearly level slopes on level landscapes and have slow permeability, moderately slow surface runoff, and a high water table during the growing season. Plum Coulee soils are non-eroded, nonstony, and occasionally slightly saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie-meadow and tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Plum Coulee soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah horizon, 13 to 25 cm thick, with firm to friable consistence, a dark grayish brown Bmgj horizon, 15 to 30 cm thick with compound weak, medium prismatic and moderate medium granular structure, and a stratified clay textured Ckgj horizon with gypsum crystals.

Plum Coulee soils occur in close association with Deadhorse soils. They are similar to Deadhorse soils by having an imperfectly drained profile in stratified clayey sediments but differ from them in having a brownish gray Bmgj horizon. Plum Coulee soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Poolex Series (POX)

The Poolex series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS,LVFS,FSL,SL), lacustrine and fluvial deposits. These soils occur in level to depressional positions of nearly level slopes on undulating landscapes and have moderate permeability, slow surface runoff, and a high to ponded water table during the growing season. Poolex soils are noneroded, nonstony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Poolex soil the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, 1 to 4 cm thick, a very dark gray Ah horizon, 15 to 22 cm thick, an olive gray to gray AC horizon, 6 to 12 cm thick, with moderate calcareousness and a Cca horizon, 10 to 15 cm thick. The parent material is typically olive brown to pale olive with yellowish brown mottles.

Poolex soils occur in close association with Pleasant and Gateside soils. They are similar to Vordas soils by having a poorly drained profile in loamy deposits but differ from them in having slightly coarser textures. Poolex soils were previously mapped as Meadow associates of the Holland Association in the Carberry (1957) soil report.

Prodan Series (PDA)

The Prodan series is a Gleyed Rego Black, carbonated soil developed on imperfectly drained, strongly to very strongly calcareous, fine loamy (CL, SiCL,SCL), lacustrine sediments. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate to moderately slow permeability, moderately slow surface runoff, and a high water table during the growing season. Prodan soils are noneroded, nonstony, and frequently slightly saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation in- cludes prairie-meadow grasses, tall prairie grasses and mixed shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Prodan soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a dark gray to gray AC horizon, 8 to 15 cm thick with moderate calcareousness, a Cca horizon, 5 to 8 cm thick and a light brownish gray Ckgj horizon with yellowish brown mottles.

Prodan soils occur in close association with Ramada, Charman and Tadpole soils. They are similar to Charman soils by having imperfect drainage and loamy sediments but differ from them in having no prominent Bmgj horizon. Prodan soils were previously mapped as Calcareous Black Meadow associates of the Carroll and Holland

Associations in the Carberry (1957) soil report.

Prosser Series (PSE)

The Prosser series consists of moderately well to well drained Orthic Black soil developed on moderately to strongly calcareous, deep, coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits. These soils occur on upper positions of very gentle to nearly level slopes on undulating landscapes and have moderately rapid permeability, moderately slow surface runoff, and a low water table during the growing season. Prosser soils are noneroded, nonstony and nonsaline. They have a medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, aspen-oak groves, shrubs and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Prosser soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a dark brown to brown Bm horizon, 12 to 20 cm thick, a pale brown BC horizon and usually a Cca horizon 12 to 18 cm thick, underlain by a Ck horizon.

Prosser soils occur in close association with Gateside, Pleasant and Poolex soils. They are similar to Fairland soils by having an Orthic Black profile, but differ from them by having a coarse loamy texture. Prosser soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Ramada Series (RAM)

The Ramada series consists of well to moderately well drained Orthic Black soil developed on strongly to very strongly calcareous, deep, uniform, fine loamy (CL,SiCL,SCL), lacustrine sediments. These soils occur in middle and upper positions of very gentle slopes on undulating landscapes and have moderate to moderately slow permeability, moderately rapid surface runoff, and a low water table during the growing season. Ramada soils are occasionally slightly eroded and are nonstony and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes prairie grasses, aspen, oak and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Ramada soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ap horizon, 10 to 20 cm thick, a dark grayish brown to brown Bm horizon, 8 to 12 cm thick, a BC horizon, 6 to 10 cm thick with weak calcareousness and a pale brown to light yellowish brown Ck horizon.

Ramada soils occur in close association with Charman and Prodan soils. They are similar to Charman soils by having a well developed profile in fine loamy sediments but differ from them in having a prominent Bm horizon as opposed to a Bmgj horizon in the imperfectly drained Charman soils. Ramada soils were previously mapped as Blackearth associates of the Carroll and Holland Associations in the Carberry (1957) soil report.

Rathwell Series (RWL)

The Rathwell series consists of imperfectly drained Gleyed Black soil developed on strongly calcareous, deep, uniform, fine loamy (CL,SiCL, SCL), lacustrine sediments. These soils occur in middle positions of very gentle slopes on level to undulating landscapes and have moderate to moderately slow permeability, moderate surface runoff, and a high water table during the growing season. Rathwell soils are noneroded, nonstony, and often slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, prairie-meadow grasses and deciduous trees and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Rathwell soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon, 20 to 30 cm thick, a brown Bmgj horizon, 15 to 20 cm thick, with distinct mottles, a transitional BC horizon, 8 to 12 cm thick and a Ckgj horizon with many distinct mottles.

Rathwell soils occur in close association with Eigenhof and Neuhorst soils. They are similar to Rignold soils by having imperfect drainage and loamy surface sediments but differ from them in having no clayey substrate. Rathwell soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Red River Series (RIV)

The Red River series consists of imperfectly drained Gleyed Rego Black soils developed on moderately to strongly calcareous, deep, uniform, clayey (C,SiC,HC) lacustrine sediments. These soils occur in level to upper positions of level to very gentle slopes on level landscapes and have slow permeability, slow to moderate surface runoff and a medium water table during the growing season. Red River soils are noneroded, nonstony and may be saline. They have medium to high available water holding capacity, medium organic matter content, and medium natural fertility. The majority of these soils are currently used for crop production.

In a representative profile of Red River soil the solum is approximately 30 cm thick. The profile is characterized by a black to very dark gray Ap horizon, 15 to 20 cm thick, a very dark gray Ah horizon, 8 to 10 cm thick, a thin, dark gray, calcareous ACkgj horizon, 6 to 10 cm thick and a dark grayish brown, calcareous, Ckgj horizon with faint mottles. The parent material is typically a uniform clay. A typical profile exhibits frequent tonguing of the A horizon into the Ckgj horizon.

Red River soils occur in very close association with Scanterbury and Osborne soils. They are similar to the above soils by having developed on the same parent material but differ because of drainage and profile development. Red River soils were previously mapped as the Red River Association in the Carberry (1957) soil report.

Reinfeld Series (RFD)

The Reinfeld series consists of moderately well to well drained Orthic Black soil developed on moderately to strongly calcareous, shallow, stratified, loamy (VFSL,L,SiL) lacustrine sediments grading to moderately calcareous, fine loamy (CL,SiCL,SCL), lacustrine sediments. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderate permeability, moderate surface runoff, and a low water table during the growing season. Reinfeld soils are noneroded, nonstony, and nonsaline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Reinfeld soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 40 cm thick, a brown Bm horizon, 15 to 25 cm thick, and a pale brown Ck horizon with occasional faint mottles.

Reinfeld soils occur in close association with Gnadenthal and Blumenfeld soils. They are similar to Denham soils by having a well drained Orthic Black profile and a loamy surface but differ from them in having no clayey substrate. Reinfeld soils were previously mapped as Blackearth associates of the Rathwell Association in the Carberry (1957) soil report.

Reinland Series (RLD)

The Reinland series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, stratified, deep, coarse loamy (VFS,LVFS,FSL,SL), fluvial and lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate to moderately rapid permeability, moderate surface runoff, and a high water table during the growing season. Reinland soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses and deciduous tree clumps. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Reinland soil the solum is approximately 25 cm thick. The profile is characterized by very dark gray Ah horizon, 15 to 30 cm thick, with weak calcareousness, a dark gray to grayish brown AC horizon, 8 to 20 cm thick, a light gray Cca horizon, 8 to 10 cm thick and a pale brown to light gray Ckgj horizon with faint mottles.

Reinland soils occur in close association with Kronstal and Osterwick soils. They are similar to Rosebank soils by having imperfect drainage and a coarse loamy surface but differ from them in having no clayey substrate. Reinland soils were previously mapped as Calcareous Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Rignold Series (RGD)

The Rignold series consists of imperfectly drained Gleyed Black soil developed on a mantle (60 to 90 cm) of moderately calcareous, shallow, uniform, loamy (VFSL,L,SiL,CL,SiCL, SCL), fluvial and lacustrine sediments over moderately calcareous, deep, uniform, clayey (SiC,C), lacustrine sediments. These soils occur in middle positions of nearly level slopes on level landscapes and have moderate surface permeability and slow to very slow permeability at depth, slow surface runoff, and a high water table during the growing season. Rignold soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, meadow grasses and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Reinland soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a light brown Bmgj horizon, 20 to 30 cm thick, a transitional BC horizon, 10 to 15 cm thick, with faint mottles and a light olive brown Ckgj horizon with fine yellowish brown mottles.

Rignold soils occur in close association with Denham, Graysville and Edkins soils. They are similar to Graysville soils by having imperfect drainage and loamy over clayey sediments but differ from them in having a prominent Bmgj horizon. Rignold soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Rosebank Series (RBK)

The Rosebank series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 95 cm) of moderately to strongly calca- reous, shallow, sandy (FS,LFS,LS) to coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine sediments. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderate surface permeability grading to slow to very slow permeability, slow surface runoff, and a high water table during the growing season. Rosebank soils are noneroded, non-stony, and often slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Rosebank soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 15 to 32 cm thick, with weak granular structure, a dark gray to grayish brown AC horizon, 10 to 15 cm thick with granular structure, friable to loose consistence, and a pale brown, friable to loose, Ckgj with faint mottles. Calcium carbonate concretions and many fine to medium mottles often occur at the clay contact. The parent material is typically mildly alkaline. A typical profile is often weakly to moderately calcareous throughout.

Rosebank soils occur in close association with Hibsin and Elm Creek soils. They are similar to Reinland soils by having a coarse loamy imperfectly drained profile but differ from them in having a clayey substrate. Rosebank soils were previously mapped as Calcareous Black Meadow associates of the Almasippi, clay substrate phase, Association in the Carberry (1957) soil report.

St. Claude Series (SUE)

The St. Claude series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (50 to 75 cm) of strongly to very strongly calcareous, shallow, loamy (VFSL,L,SiL), lacustrine sediments over moderately calcareous, uniform, shallow, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in middle to lower positions of very gentle to gentle slopes on hummocky landscapes and have moderately slow to slow surface permeability grading to rapid permeability with depth, slow surface runoff, and a high water table during the growing season. St. Claude soils are noneroded, nonstony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes aspen, black poplar, willow and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of St. Claude soil the solum is approximately 15 cm thick. The profile is characterized by a dark gray, strongly calcareous Ahk horizon, 13 to 20 cm thick, a strongly to extremely calcareous Cca or AC horizon, 13 to 25 cm thick with prominent mottles, and a light yellowish brown to olive gray, moderately calcareous Ckg horizon with many prominent mottles.

The parent material is typically finer textured at 1.5 to 5 meters in depth. A typical profile also contains a high content of silt and clay sized secondary carbonates but little silt or clay silicate mineral material in the loamy sediments.

St. Claude soils occur in close association with Neuenberg and Jasset soils. They are similar to Almasippi soils by having imperfect drainage and a sandy substrate but differ from them in having a prominent loamy or silty Cca or AC horizon. St. Claude soils were previously mapped as Calcareous Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Scanterbury Series (SCY)

The Scanterbury series consists of imperfectly drained Gleyed Black soil developed on moderately to strongly calcareous, deep, uniform, clayey, (C,SiC,HC), lacustrine sediments. These soils occur in level to upper portions of level to very gentle slopes on level landscapes and have slow permeability, slow to moderate surface runoff and a medium water table during the growing season. Scanterbury soils are noneroded, non-stony and nonsaline. They have medium to high available water holding capacity, medium organic matter content, and medium natural fertility. The majority of these soils are currently used for crop production.

In a representative profile of Scanterbury soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 30 cm thick, which frequently tongues through a very dark gray to dark grayish brown Bngj horizon, 12 to 40 cm thick, a very dark grayish brown BC, 10 to 15 cm thick, and an olive gray calcareous Ckgj horizon with many, fine, faint mottles.

Scanterbury soils occur in very close association with Red River and Osborne soils. They are similar to Red River soils by having a uniform clayey texture but differ from them in having a prominent Bngj horizon. Scanterbury soils were previously mapped as Black Meadow associates of the Red River Association in the Carberry (1957) soil report.

Sewell Series (SEE)

The Sewell series consists of poorly drained Rego Humic Gleysol soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine and fluvial deposits. These soils occur in depressional positions of gentle slopes on hummocky landscapes and have moderately rapid permeability, very slow surface runoff, and a high to ponded water table during the growing season. Sewell soils are noneroded, nonstony, and often slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Sewell soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray to gray AC horizon, 10 to 15 cm thick with carbonates and mottles, and usually a Cca horizon, 5 to 8 cm thick. A typical profile also contains an olive to pale olive Ckg horizon with yellowish brown mottles and manganese concretions.

Sewell soils occur in close association with Stockton, Lavenham and Hummerston soils. They are similar to Osterwick soils by having poor drainage and a Rego Humic Gleysol profile but differ from them in having sandy rather than coarse loamy deposits. Sewell soils were previously mapped as Meadow associates of the Stockton Association in the Carberry (1957) soil report.

Shellmouth Complex (SEL)

The Shellmouth Complex consists of well to excessively drained Orthic Regosol soil developed on variable textured deposits. These soils occur in crest to lower positions of very strong to extreme slopes on river and streambank landscapes and have variable permeability, rapid surface runoff, and a low water table during the growing season. Shellmouth soils are actively severely eroded, non-stony, and nonsaline. They have variable available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes forests of aspen, oak and willow. The majority of these soils are too steep to be cultivated.

In a representative profile of Shellmouth soil the solum is not developed. The profile is characterized by a very thin LF horizon, 1 to 3 cm thick, with leaf litter and a Ck horizon.

Shellmouth soils occur in close association with alluvial soils along stream banks. Shellmouth soils were previously mapped as Eroded Slopes in the Carberry (1957) soil report.

Shilox Series (SHX)

The Shilox series consists of moderately well to excessively drained Orthic Regosol soil developed on weakly to noncalcareous, deep, uniform, sandy (FS,LFS,LS), eolian deposits. These soils occur in middle and upper positions of moderate to strong slopes on hummocky to duned landscapes and have rapid to very rapid permeability, very slow surface runoff, and a low water table during the growing season. Shilox soils are severely wind eroded, nonstony, and nonsaline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes open stands of oak, white spruce, juniper and prairie grasses. The majority of these soils are currently wooded.

In a representative profile of Shilox soil the solum is only weakly developed. The profile is characterized by a partially decomposed LH horizon, 1 to 2 cm thick, a grayish brown to pale brown Ah horizon, 6 to 10 cm thick, and a light yellowish brown to pale brown C horizon. A typical profile also contains an occasional buried Ah horizon, 2 to 4 cm thick.

Shilox soils occur in close association with Onahan and Mockry soils. They are similar to Arizona soils by having a Regosolic profile in sandy deposits but differ from them in having less stratification and more uniform textures. Shilox soils were previously mapped as immature associates of the Stockton Association in the Carberry (1957) soil report.

Skelding Series (SKL)

The Skelding series consists of excessively drained Orthic Regosol soil developed on weakly calcareous, deep, uniform, sandy (FS,LFS,LS), recent eolian deposits. These soils occur in upper positions of gentle slopes on duned landscapes and have rapid to very rapid permeability, very slow surface runoff, and a low water table during the growing season. Some Skelding soils occur on active dunes and experience severe wind erosion. Skelding soils are non-stony, and nonsaline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen, juniper, oak and short prairie grasses. The majority of these soils are currently stabilized by supporting growth of native or seeded grasses.

In a representative profile of Skelding soil the solum is very weakly developed. The profile is characterized by a dark yellowish brown Ah horizon, 5 to 10 cm thick, and a dark yellowish brown C horizon. A typical profile extends to more than a meter before carbonates occur.

Skelding soils occur in close association with Long Plain, Almasippi and Leland soils. They are similar to Shilox soils by having sandy eolian deposits and a Regosolic profile but differ from them by occurring in a slightly warmer climate. Skelding soils were previously mapped as immature associates of the Almasippi Association in the Carberry (1957) soil report.

Squirrel Creek Series (SQR)

The Squirrel Creek series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 90 cm) of strongly to very strongly calcareous, shallow, loamy (VFSL,L,SiL,CL,SiCL,SCL), lacustrine sediments over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine sediments. These soils occur in middle positions of gentle to very gentle slopes on undulating landscapes and have moderately slow surface permeability grading to slow permeability with depth, slow surface runoff, and a high water table during the growing season. Squirrel Creek soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, willow, poplar and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Squirrel Creek soil the solum is approximately 15 cm thick. The profile is characterized by a dark gray Ah horizon, 13 to 20 cm thick, with strong calcareousness, an AC or Cca horizon, 13 to 25 cm thick with strong to extreme calcareousness, and a moderately calcareous clayey IICkgj horizon with prominent iron mottles. A typical profile also contains sandy strata above the clay substrate.

Squirrel Creek soils occur in close association with Denham, Rignold and Edkins soils. They are similar to St. Claude soils by having a prominent Cca horizon and imperfect drainage but differ from them in having a clayey substrate. Squirrel Creek soils were previously mapped as Calcareous Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Stockton Series (SCK)

The Stockton series consists of moderately well to well drained Orthic Black soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in upper positions of gentle to very gentle slopes on irregular undulating landscapes and have rapid permeability, moderate surface runoff, and a low water table during the growing season.

Stockton soils are often slightly wind eroded and are non-stony and nonsaline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, black spruce and prairie grasses. The majority of these soils are currently cultivated for grain and forage crops.

In a representative profile of Stockton soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ah horizon, 18 to 25 cm thick, a brown to grayish brown Bm horizon, 12 to 22 cm thick, a pale brown to light yellowish brown BC horizon, 8 to 12 cm thick, and a very pale brown Ck horizon with a few yellowish brown mottles. A typical profile also contains a thin Cca horizon below the BC horizon.

Stockton soils occur in close association with Lavenham and Sewell soils. They are similar to Lavenham soils by having a sandy profile but differ from them in having a prominent Bm horizon as opposed to a Bmgj horizon in the imperfectly drained Lavenham soils. Stockton soils were previously mapped as Blackearth associates of the Stockton Association in the Carberry (1957) soil report.

Tadpole Series (TDP)

The Tadpole series consists of poorly drained Rego Humic Gleysol soil developed on strongly to very strongly calcareous, deep, uniform, fine loamy (CL,SiCL,SCL), lacustrine sediments. These soils occur in depressional positions of nearly level slopes on undulating landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Tadpole soils are noneroded, nonstony, and frequently moderately saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, reeds, rushes and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Tadpole soil the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 6 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray AC horizon, 4 to 6 cm thick with moderate calcareousness and an olive to olive gray Ckg horizon with distinct yellowish brown mottles.

Tadpole soils occur in close association with Ramada and Charman soils. They are similar to Vordas soils by having poor drainage and lacustrine sediments but differ from them in having fine loamy rather than loamy textures. Tadpole soils were previously mapped as Meadow associates of the Carroll or Firdale Association in the Carberry (1957) soil report.

Taggart Series (TGR)

The Taggart series consists of imperfectly drained Gleyed Rego Black soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,L,SiL), lacustrine sediments. These soils occur in middle positions of gentle to very gentle slopes on undulating landscapes and have moderate permeability, slow surface runoff, and a high water table during the growing season. Taggart soils are noneroded, nonstony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, willow and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Taggart soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 24 cm thick, a dark gray AC horizon, 5 to 15 cm thick with moderate calcareousness, a Cca horizon, 8 to 12 cm thick with lime carbonates and an olive brown Ckgj horizon with yellowish brown mottles. A typical profile also contains gypsum crystals below the Cca horizon.

Taggart soils occur in close association with Fairland, Torcan and Vordas soils. They are similar to Torcan soils by having imperfect drainage and loamy sediments but differ from them in having no prominent Bmgj horizon. Taggart soils were previously mapped as Calcareous Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Torcan Series (TOC)

The Torcan series consists of imperfectly drained Gleyed Black soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,L,SiL), lacustrine sediments. These soils occur in middle to lower positions of very gentle slopes on rolling to undulating landscapes and have moderate permeability, moderately slow surface runoff, and a medium water table during the growing season. Torcan soils are noneroded, nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, willow, shrubs and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Torcan soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray Ah horizon 18 to 25 cm thick, a light brown Bmgj horizon, 10 to 18 cm thick, with yellowish brown mottles, a Cca horizon, 8 to 12 cm thick, and a light olive brown Ckgj horizon with yellowish brown mottles.

Torcan soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Taggart soils by having imperfect drainage and loamy sediments but differ from them in having a prominent Bmgj horizon. Torcan soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Vordas Series (VDS)

The Vordas series consists of poorly drained Rego Humic Gleysol soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,L,SiL), lacustrine sediments. These soils occur in level to depressional positions of very gentle slopes on undulating landscapes and have moderate permeability, very slow surface runoff, and a high to ponded water table during the growing season. Vordas soils are noneroded, nonstony, and often slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Vordas soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray AC horizon, 4 to 6 cm thick with carbonates and mottles, and an olive to pale olive Ckg horizon with yellowish brown iron mottles. A typical profile also contains white pseudomycelia of salt in the Ah and AC horizons in saline areas.

Vordas soils occur in close association with Fairland, Taggart and Torcan soils. They are similar to Tadpole soils by having poor drainage but differ from them in having slightly coarser textures. Vordas soils were previously mapped as Meadow associates of the Holland Association in the Carberry (1957) soil report.

Wellwood Series (WWD)

The Wellwood series consists of well to moderately well drained Orthic Black soil developed on a mantle (25 to 75 cm) of strongly calcareous, shallow, uniform, fine loamy (CL,SiCL,SCL), lacustrine sediments over moderately calcareous, deep, uniform, sandy (FS,LFS,LS), glaciofluvial deposits. These soils occur in upper positions of gentle to very gentle slopes on undulating to hummocky landscapes and have moderate surface permeability grading to rapid permeability with depth, moderate to moderately slow surface runoff, and a low water table during the growing season. Wellwood soils are occasionally slightly eroded and are non-stony and nonsaline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Wellwood soil the solum is approximately 45 cm thick. The profile is characterized by a black to very dark gray Ah horizon, 18 to 30 cm thick, a dark brown to brown Bm horizon, 16 to 24 cm thick with prismatic to subangular blocky structure, a yellowish brown to pale brown BC horizon, 8 to 14 cm thick, and a Cca horizon, 7 to 10 cm thick with lime accumulation and a moderately calcareous stratified, fine sand IICk horizon.

Wellwood soils occur in close association with Oberon soils. They are similar to Glenboro soils by having an Orthic Black profile and sandy substrate but differ from them in having a fine loamy rather than loamy surface texture. Wellwood soils were previously mapped as Blackearth associates of the Wellwood Association in the Carberry (1957) soil report.

Willowbend Series (WWB)

The Willowbend series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, stratified, deep, loamy (VFSL,SiL,L,SiCL,CL), recent alluvial sediments. Strata can vary in texture from FS to CL depending on source area and position relative to stream channels. These soils occur in level to depressional positions of very gentle slopes on flood prone terraces and meander landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Willowbend soils are noneroded, nonstony, and often moderately saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Willowbend soil the solum is only very weakly developed. The profile is characterized by a moderately decomposed LH horizon, 5 to 10 cm thick, a very dark gray Ahk horizon, 15 to 20 cm thick with moderate calcareousness, and a light brownish gray to very pale brown Ckg horizon with many prominent mottles. Buried Ah horizons often occur throughout the soil profile.

Willowbend soils occur in close association with La Salle and Gervais soils. They are similar to Gervais soils by having stratified loamy alluvial materials but differ from them in having imperfect drainage. Willowbend soils were previously mapped as immature Meadow associates of the Riverdale Association in the Carberry (1957) soil report.

Willowcrest Series (WWC)

The Willowcrest series consists of imperfectly drained Gleyed Black soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine deposits. Finer textured deposits underlie the sands at depths of 1.5 to 3.5 meters. These soils occur in middle positions of gentle slopes on undulating landscapes and have moderately rapid to rapid permeability, moderate surface runoff, and a medium to high water table during the growing season. Willowcrest soils are occasionally slightly eroded, nonstony, and very occasionally slightly saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, willow, shrubs and prairie grasses. The majority of these soils are currently cultivated for forage or grain crops.

In a representative profile of Willowcrest soil the solum is approximately 55 cm thick. The profile is characterized by a very dark gray to very dark brown Ah horizon, 18 to 25 cm thick, a dark brown to yellowish brown Bmgj horizon, 25 to 40 cm thick, with distinct iron mottles, a Cca horizon, 13 to 20 cm thick and a pale brown Ckgj horizon with many prominent mottles.

Willowcrest soils occur in close association with Almasippi, Long Plain and Lelant soils. They are similar to Almasippi soils by having imperfect drainage and sandy deposits but differ from them in having a prominent Bmgj horizon. Willowcrest soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Xavier Series (XVI)

The Xavier series consists of very poorly drained Typic Mesisol soil developed on deep (>160 cm), moderately decomposed, mesic fen peat deposits. These soils occur in depressional positions of level slopes on level landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Xavier soils are noneroded, nonstony and nonsaline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes sedges, rushes, reeds and willow. The majority of these soils are currently in native vegetation.

Xavier soil is characterized by a dark yellowish brown Of horizon of fibric sedge peat, 10 to 30 cm thick, which is medium acid to neutral and a thick, very dark brown, medium acid to neutral Om horizon, grading into a black, weakly acid to weakly calcareous Oh horizon. Underlying mineral strata range in texture from loam to clay.

Xavier soils are similar to Perillo soils by having very poor drainage and organic deposits but differ from them in having deep (>160 cm) rather than shallow (40-160 cm) organic deposits.

PART 4

4 USE AND MANAGEMENT INTERPRETATIONS OF SOILS

4.1 INTRODUCTION

This section provides predictions of performance or soil suitability ratings for various uses of soils based on field observations of soil and landscape characteristics, laboratory data and on observations of soil behavior under specified conditions of land use and manage-ment. Suitability ratings or interpretations are intended only to serve as guides for planners and managers. Caution, with an understanding of the limitations of the soil map must be exercised when applying suitability ratings to soil map units. The value of any rating or interpretation depends upon the nature and composition of individual map unit delineation which in turn depends on the scale of mapping and intensity of ground truthing employed in the survey.

In this section, interpretive soil information is provided for the following land use evaluations:

1. Agriculture
    a) dryland farming capability
    b) irrigation suitability
2. Engineering Uses
3. Recreation Uses

4.2 SOIL CAPABILITY FOR AGRICULTURE

4.2.1 Dryland Agriculture

Soil capability classification for dryland agriculture is based on an evaluation of both internal and external soil characteristics that influence soil suitability and limitations for agricultural use. In this classification, mineral soils are grouped into capability classes, and subclasses and units based on their limitations for dryland farming, risk of damage when the soils are used and the way they respond to management (Anon, 1965). There are seven capability classes, each of which groups soils together that have the same relative degree of limitation or hazard for agricultural use. The limitation becomes pro- gressively greater from Class 1 to Class 7. The class indicates the general suitability of the soils for agriculture. The first three classes are considered capable of sustained production of common field crops, the fourth is marginal for sustained arable agriculture, the fifth is suitable only for improved permanent pasture, the sixth is capable of use only for native pasture while the seventh class is for soils and land types considered incapable of use for arable agriculture or permanent pasture.

Organic soils within the map area are rated for "potential" agricultural capability after the method of Leeson et. al. (1969). Capability ratings of organic soils for agriculture must recognize that most organic soils have little or no value for agriculture in their native state and their potential is only achieved through reclamation or development implemented with varying degrees of difficulty. Capability class definitions for organic soils are the same as for mineral soils. They are however, identified on maps and tables with the prefix "O".

Soil Capability subclasses are divisions within classes which group soils with similar kinds of limitations and hazards for agricultural use. The various kinds of limitations recognized at the subclass level are defined in Table 4.

Table 5 presents the interpretive classification for dryland agriculture of these soils.

Table 6 is a summary of the soils within the study area represented by their major characteristics and providing the areal extent of each.

Definitions of the Agricultural Capability Classes

Class 1

Soils in this class have no important limitations for crop use. The soils have level or gently sloping topography; they are deep, well to imperfectly drained and have moderate water holding capacity. The soils are naturally well supplied with plant nutrients, easily maintained in good tilth and fertility; soils are moderately high to high in productivity for a wide range of cereal and special crops.

Class 2

Soils in this class have moderate limitations that reduce the choice of crops or require moderate conservation practices. The soils have good water holding capacity and are either naturally well supplied with plant nutrients or are highly responsive to inputs of fertilizer. They are moderate to high in productivity for a fairly wide range of crops. The limitations are not severe and good soil management and cropping practices can be applied without serious difficulty.

Class 3

Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices. The limitations in Class 3 are more severe than those in Class 2 and conservation practices are more difficult to apply and maintain. The limitations affect the timing and ease of tillage, planting and harvesting, the choice of crops and maintenance of conservation practices. The limitations include one or more of the following: moderate climatic limitation, erosion, structure or permeability, low fertility, topography, overflow, wetness, low water holding capacity or slowness in release of water to plants, stoniness and depth of soil to consolidated bedrock. Under good management, these soils are fair to moderately high in productivity for a fairly wide range of field crops.

Class 4

Soils in this class have severe limitations that restrict the choice of crops or require special conservation practices or both. These soils have such limitations that they are only suited for a few crops, or the yield for a range of crops may be low, or the risk of crop failure is high. The limitations may seriously affect such farm practices as the timing and ease of tillage, planting and harvesting, and the application and maintenance of conservation practices. These soils are low to medium in productivity for a narrow range of crops but may have higher productivity for a specially adapted crop. The limitations include the adverse effects of one or more of the following: climate, accumulative undesirable soil characteristics, low fertility, deficiencies in the storage capacity or release of soil moisture to plants, structure or permeability, salinity, erosion, topography, overflow, wetness, stoniness, and depth of soil to consolidated bedrock.

Class 5

Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible. These soils have such serious soil, climatic or other limitations that they are not capable of use for sustained production of annual field crops. However, they may be improved by the use of farm machinery for the production of native or tame species of perennial forage plants. Feasible improvement practices include clearing of bush, cultivation, seeding, fertilizing and water control.

Some soils in Class 5 can be used for cultivated field crops provided unusually intensive management is used. Some of these soils are also adapted to special crops requiring soil conditions unlike those needed by the common crops.

Class 6

Soils in this class are capable only of producing perennial forage crops and improvement practices are not feasible. Class 6 soils have some natural sustained grazing capacity for farm animals, but have such serious soil, climatic or other limitations as to make impractical the application of improvement practices that can be carried out on Class 5 soils. Soils may be placed in this class because their physical nature prevents the use of farm machinery, or because the soils are not responsive to improvement practices, or because stock watering facilities are inadequate.

Class 7

Soils in this class have no capability for arable culture or permanent pasture because of extremely severe limitations. Bodies of water too small to delineate on the map are included in this class. These soils may or may not have a high capability for forestry, wildlife and recreation.

Table 4. Agricultural Capability Subclass Limitations

C- Adverse climate: This subclass denotes a significant adverse climate for crop production as compared to the "median" climate which is defined as one with sufficiently high growing season temperatures to bring field crops to maturity, and with sufficient precipitation to permit crops to be grown each year on the same land without a serious risk of partial or total crop failures.

D- Undesirable soil structure and/or low permeability: This subclass is used for soils difficult to till, or which absorb water very slowly or in which the depth of rooting zone is restricted by conditions other than a high water table or consolidated bedrock.

E- Erosion: Subclass E includes soils where damage from erosion is a limitation to agricultural use. Damage is assessed on the loss of productivity and on the difficulties in farming land with gullies.

F- Low fertility: This subclass is made up of soils having low fertility that either is correctable with careful management in the use of fertilizers and soil amendments or is difficult to correct in a feasible way. The limitation may be due to lack of available plant nutrients, high acidity or alkalinity, low exchange capacity, high levels of carbonates or presence of toxic compounds.

I- Inundation by streams or lakes: This subclass includes soils subjected to inundation causing crop damage or restricting agricultural use.

L- Coarse wood fragments: In the rating of organic soils, woody inclusions in the form of trunks, stumps and branches (> 10 cm diameter) in sufficient quantity to significantly hinder tillage, planting and harvesting operations.

M- Moisture limitation: This subclass consists of soils where crops are adversely affected by droughtiness owing to inherent soil characteristics. They are usually soils with low water-holding capacity.

N- Salinity: Designates soils which are adversely affected by the presence of soluble salts.

P- Stoniness: This subclass is made up of soils sufficiently stony to significantly hinder tillage, planting, and harvesting operations. Stony soils are usually less productive than comparable non-stony soils.

R- Consolidated bedrock: This subclass includes soils where the presence of bedrock near the surface restricts their agricultural use. Consolidated bedrock at depths greater than 1 meter from the surface is not considered as a limitation, except on irrigated lands where a greater depth of soil is desirable.

T- Topography: This subclass is made up of soils where topography is a limitation. Both the percent of slope and the pattern or frequency of slopes in different directions are important factors in increasing the cost of farming over that of smooth land, in decreasing the uniformity of growth and maturity of crops, and in increasing the hazard of water erosion.

W- Excess water: Subclass W is made up of soils where excess water other than that brought about by inundation is a limitation to their use for agriculture. Excess water may result from inadequate soil drainage, a high water table, seepage or runoff from surrounding areas.

X- Cumulative minor adverse characteristics: This subclass is made up of soils having a moderate limitation caused by the cumulative effect of two or more adverse characteristics which singly are not serious enough to affect the class rating.

4.2.2 Irrigation Suitability

Irrigation suitability of soils is determined by evaluating the nature of both internal and external soil characteristics (PFRA, 1964). The classification of soils for irrigation suitability consists of three categories: class, subclass and unit.

The suitability class groups soils having the same relative suitability or degree of limitation or hazard for irrigation use. Four classes are utilized grading from Class 1, which is very good to Class 4, which is poor. The four classes are:

Class 1 - Very good: These are soils of fine sandy loam to clay loam texture which are well suited for irrigation use. The soils have good water retention capacity, good permeability, low salt content, good drainage and low general gradient of land surface.

Class 2 - Good: These are soils of loamy fine sand to light clay texture which are moderately well suited for irrigation use. Slight limitation to use results from soil factors such as water holding capacity, permeability, depth of material, salt content, topographic factors such as slope and pattern or drainage restrictions arising from surface drainage and depth to water table.

Class 3 - Fair: These are coarse or fine textured soils which are fair to marginally suitable because of some unfavorable characteristics that limit production and cause management problems under irrigation use. Soil, topographic or drainage factors are more restrictive than in Class 2.

Class 4 - Poor: These are soils that are considered poor to unsuitable for irrigation use because of severe drainage problems, impermeable geologic material, salinity, very low water holding capacity, very rapid permeability, topography or a combination of these problems.

The suitability subclass identifies soils with similar kinds of limitations and hazards related to both internal and external soil characteristics. The internal characteristics include both permanent and non-permanent properties; the permanent properties are those that will not change over time whereas the non-permanent properties may be altered with time by specific management. The properties which affect irrigation suitability of soil are listed as follows:

1. Internal Characteristics
    a) Permanent - Texture, uniformity and depth of geologic deposit, hydraulic conductivity and water storage capacity
    b) Non-permanent - Structure, drainage, fertility, reaction, salinity, exchangeable sodium
2. External Characteristics
    a) Topography, erosion, stoniness, vegetative cover

The classification criteria for irrigation suitability are summarized in Table 11, Appendix E. The soils of the Study area are evaluated for irrigation suitability in Table 5.

4.3 SOIL SUITABILITY FOR SELECTED ENGINEERING USES

This section provides information which can be used by engineers and land use planners concerned with engineering and related geotechnical aspects of soil. It is intended to supplement the information on the soil map with additional data on engineering properties of soils.

The criteria used to evaluate soil suitability for selected engineering and related recreational uses are adopted from guides found in Coen et al (1977), and from guidelines developed by the Soil Conservation Service, United States Department of Agriculture (USDA, 1971), and the Canada Soil Survey Committee (CSSC, 1973).

4.3.1 Definition of Soil Suitability Classes

Evaluation of soil suitability for engineering and recreation uses is based on both internal and external soil characteristics. Four soil suitability classes are used to evaluate both mineral and organic soils and hence, mapping units for selected uses. These ratings express relative degrees of suitability or limitation for potential uses of natural or essentially undisturbed soils. The long term effects of the potential use on the behavior of the soil are considered in the rating.

The four suitability class ratings are defined as follows:

Good -	Soils in their present state have few or minor limitations that would affect the proposed use. The limitations would easily be overcome with minimal cost.
Fair -	Soils in their present state have one or more moderate limitations that would affect the proposed use. These moderate limitations would be overcome with special construction, design, planning or maintenance.
Poor -	Soils in their present state have one or more severe limitations that would severely affect the proposed use. To overcome these severe limitations would require the removal of the limitation or difficult and costly alteration of the soil or of special design or intensive maintenance.
Very Poor -	Soils have one or more features so unfavorable for the proposed use that the limitation is very difficult and expensive to overcome or the soil would require such extreme alteration that the proposed use is economically impractical.

Table 5. Agricultural Capability Classes for Soils

Map Symbol and Phase		Soil Name	Agricultural Capability Class	Irrigation Suitability
ASS		Almasippi	2M	2SD
ASS	/oxxx	Almasippi	3ME	3SD
ASS	/1xxx	Almasippi	3ME	3SD
ASS	/2xxx	Almasippi	3ME	3SD
ASS	/xcxx	Almasippi	3M	3SD
ASS	/ocxx	Almasippi	3EM	3SD
ASS	/1cxx	Almasippi	3ME	3SD
ASS	/xdxx	Almasippi	3TM	3ST
AIZ		Arizona	4M	4S
AIZ	/xdxx	Arizona	4M	4S
AIZ	/3dxx	Arizona	4ME	4S
ARN		Aronet	4ME	4S
BKA		Birkenhead	5M	4S
BKA	/xcxx	Birkenhead	5M	4S
BKA	/2cxx	Birkenhead	5M	4S
BKA	/2exx	Birkenhead	5M	4S
BNF		Blumenfeld	3W	4D
BNFp		Blumenfeld	6W	4SD
BNF	/xxxs	Blumenfeld	5W	4DS
BNE		Bone	2W	2D
BNE	/xcxx	Bone	2WT	2D
BNE	/1dxx	Bone	3T	3T
CXV	/ocxx	Charman	2W	2T
DLN		Danlin	2W	2SD
DLN	/ocxx	Danlin	2W	2T
DLN	/xdxx	Danlin	3T	3T
DHO		Deadhorse	2W	4S
DNH		Denham	1	3S
DNH	/xcxx	Denham	2T	3S
DOB		Dobbin	3M	3S
DOB	/xcxx	Dobbin	3M	3S
DOB	/ocxx	Dobbin	3M	3S
DOB	/1cxx	Dobbin	3ME	3S
DOB	/2cxx	Dobbin	3ME	3S
DOB	/3cxx	Dobbin	3ME	3S
DOB	/xdxx	Dobbin	3MT	3ST
DOB	/odxx	Dobbin	3MT	3ST
DOB	/1dxx	Dobbin	3MT	3ST
DOB	/2dxx	Dobbin	3MT	3ST
DOB	/3dxx	Dobbin	4EM	3ST
DOB	/xexx	Dobbin	4T	4T
DOB	/oexx	Dobbin	4T	4T
DOB	/1exx	Dobbin	4T	4T
DOB	/2exx	Dobbin	4TE	4T
DOB	/3exx	Dobbin	4ET	4T
DOB	/xfxx	Dobbin	5T	4T
DOB	/1fxx	Dobbin	5T	4T
DOB	/2fxx	Dobbin	5TE	4T
EDK		Edkins	3W	4DS
EDKp		Edkins	6W	4DS
EGF		Eigenhof	1	1
EEK		Elm Creek	2M	3SD
ERX		Eroded Slope Compl	6T	4T
FND		Fairland	1	1
FND	/xcxx	Fairland	2T	2T

Table 5. Agricultural Capability Classes for Soils
(Cont'd)

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
FIR	Firdale	1	1
FIR /xcxx	Firdale	2T	2T
FIR /ocxx	Firdale	2T	2T
FIR /1cxx	Firdale	2T	2T
FIR /xdxx	Firdale	3T	3T
FIR /1dxx	Firdale	3T	3T
FIR /2dxx	Firdale	3T	3T
FIR /3dxx	Firdale	4E	3T
FIR /xexx	Firdale	4T	4T
FIR /1exx	Firdale	4T	4T
FIR /2exx	Firdale	4T	4T
FIR /3exx	Firdale	4TE	4T
FIR /xfxx	Firdale	5T	4T
FIR /1fxx	Firdale	5T	4T
FIR /2fxx	Firdale	5T	4T
FIR /3fxx	Firdale	5TE	4T
FIR /2gxx	Firdale	6T	4T
FIR /3gxx	Firdale	6T	4T
FTE	Fortier	2W	4DS
GTD	Gateside	2W	2SD
GVS	Gervais	2W	3DS
GVS /xexx	Gervais	4T	4T
GBO /xcxx	Glenboro	2T	2T
GDH	Gnadenthal	1	2D
GDH /xxxs	Gnadenthal	3N	3S
GDH /2cxx	Gnadenthal	2W	2T
GYV	Graysville	1	3SD
GYV /xxxs	Graysville	3N	3SD
GRO /xcxx	Grover	2WT	2TD
HAT	Halstead	2M	1
HAT /1xxx	Halstead	2M	1
HAT /2xxx	Halstead	2M	1
HAT /xcxx	Halstead	2T	2T
HAT /ocxx	Halstead	2T	2T
HAT /1cxx	Halstead	2T	2T
HAT /2cxx	Halstead	2T	2T
HAT /3cxx	Halstead	3E	2T
HAT /xdxx	Halstead	3T	3T
HAT /odxx	Halstead	3T	3T
HAT /1dxx	Halstead	3T	3T
HAT /2dxx	Halstead	3T	3T
HAT /3dxx	Halstead	4E	3T
HAT /xexx	Halstead	4T	4T
HAT /oexx	Halstead	4T	4T
HAT /1exx	Halstead	4T	4T
HAT /2exx	Halstead	4T	4T
HAT /3exx	Halstead	4TE	4T
HAT /xfxx	Halstead	5T	4T
HAT /1fxx	Halstead	5T	4T
HAT /2fxx	Halstead	5T	4T
HAT /3fxx	Halstead	5TE	4T
HAT /3gxx	Halstead	6T	4T
HIN	Hibsin	2M	3S
HMO	Hummerston	3M	3SD
HMO /xcxx	Hummerston	3M	3SD

Table 5. Agricultural Capability Classes for Soils (Cont'd)

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
JST	Jasset	1	2D
KOT	Kronstal	2M	2SD
KOT /1xxx	Kronstal	2M	2SD
KOT /xcxx	Kronstal	2M	2ST
LSL	La Salle	2X	1
LSL /xcxx	La Salle	2T	2T
LVH	Lavenham	3M	3SD
LVH /xcxx	Lavenham	3M	3SD
LRY	Leary	5M	4S
LLT	Lelant	5W	4D
LLT /oxxx	Lelant	5W	4D
LLTd	Lelant	3W	4D
LLTd /oxxx	Lelant	3W	4D
LLTdp	Lelant	4W	4D
LLTp	Lelant	6W	4D
LLTp /xxxs	Lelant	6W	4D
LLT /xxxs	Lelant	5W	4D
LOP	Long Plain	3M	3SD
LOP /oxxx	Long Plain	3ME	3SD
LOP /1xxx	Long Plain	3ME	3SD
LOP /2xxx	Long Plain	3ME	3SD
LOP /3xxx	Long Plain	4EM	3SD
LOP /xcxx	Long Plain	3M	3SD
LOP /ocxx	Long Plain	3EM	3SD
LOP /1cxx	Long Plain	3ME	3SD
LOP /2cxx	Long Plain	3ME	3SD
LOP /xdxx	Long Plain	3TM	3ST
LOP /xexx	Long Plain	4T	4T
LOP /xfxx	Long Plain	5T	4T
MHC	Marsh Complex	7W	4D
MKY	Mockry	5W	4D
MKYp	Mockry	6W	4D
NBG	Neuenberg	1	2D
NBG /xxxs	Neuenberg	3NW	3SD
NBG /oxxx	Neuenberg	2X	3SD
NUH	Neuhorst	1	2D
NUH /xxxs	Neuhorst	3N	3S
NWN	Newton Siding	1	2D
OBR	Oberon	2W	2D
ONH	Onahan	4MW	3S
ONH /xcxx	Onahan	4MW	4S
ONH /xexx	Onahan	4MT	4ST
ONH /xfxx	Onahan	5MT	4ST
OBO	Osborne	3W	4D
OWK	Osterwick	3W	4D
PER	Perillo	03W	4D
PTR	Petrel	2W	2D
PLE	Pleasant	2W	2SD
PLE /xcxx	Pleasant	2WT	2ST
PME	Plum Coulee	2W	4S
POX	Poolex	5W	4D
POXp	Poolex	6W	4D
PDA	Prodan	2W	2D
PDA /xcxx	Prodan	2WT	2T
PSE	Prosser	2M	1

Table 5. Agricultural Capability Classes for Soils (Cont'd)

Map Symbol and Phase		Soil Name	Agricultural Capability Class	Irrigation Suitability
RAM		Ramada	1	1
RWL		Rathwell	1	2D
RWL	/xxxs	Rathwell	3M	3SD
RIV		Red River	2W	4S
RFD		Reinfeld	1	1
RLD		Reinland	2M	2SD
RLD	/xxxs	Reinland	3NW	3SD
RLD	/oxxx	Reinland	2ME	2SD
RLD	/1xxx	Reinland	2M	2SD
RLD	/2xxx	Reinland	2ME	2SD
RLD	/1cxx	Reinland	2MT	2ST
RGD		Rignold	1	3SD
RBK		Rosebank	2M	3SD
RBK	/xxxs	Rosebank	3NW	4SD
RBK	/oxxx	Rosebank	2M	3SD
SUE		St.Claude	2W	4SD
SUE	/xxxs	St.Claude	3NW	4SD
SUE	/xxxt	St.Claude	5NW	4SD
SUE	/oxxx	St.Claude	2W	4SD
SUE	/1xxx	St.Claude	2W	4SD
SUE	/xcxx	St.Claude	2W	4SD
SCY		Scanterbury	2W	4S
SEE		Sewell	5W	4D
SEEp		Sewell	6W	4D
SEE	/xdxx	Sewell	5W	4D
SEU		Shellmouth Complex	2X	2S
SEU	/xexx	Shellmouth Complex	6E	4T
SEU	/xfxx	Shellmouth Complex	6E	4T
SEU	/3fxx	Shellmouth Complex	6E	4T
SEU	/xgxx	Shellmouth Complex	6E	4T
SHX		Shilox	5M	4S
SHX	/xcxx	Shilox	5M	4S
SHX	/xdxx	Shilox	5M	4S
SHX	/xexx	Shilox	5M	4ST
SHX	/1exx	Shilox	5M	4ST
SHX	/3exx	Shilox	5M	4ST
SHX	/xfxx	Shilox	5MT	4ST
SHX	/1fxx	Shilox	5MT	4ST
SHX	/3fxx	Shilox	5MT	4ST
SHX	/xgxx	Shilox	6T	4ST
SKL		Skelding	5M	4S
SKL	/xcxx	Skelding	5M	4S
SKL	/xdxx	Skelding	5M	4S
SKL	/xfxx	Skelding	5MT	4ST
SQR		Squirrel Creek	2W	4SD
SQR	/xxxs	Squirrel Creek	3NW	4SD
SCK		Stockton	3M	3S
SCK	/xcxx	Stockton	3M	3S
SCK	/odxx	Stockton	3MT	3ST
SCK	/2dxx	Stockton	3MT	3ST
SCK	/3exx	Stockton	4TE	4T
TDP		Tadpole	5W	4D
TDPp		Tadpole	6W	4D
TGR		Taggart	2W	2D
TOC		Torcan	2W	2D

Table 5. Agricultural Capability Classes for Soils
(Cont'd)

Map Symbol and Phase		Soil Name	Agricultural Capability Class	Irrigation Suitability
VDS		Vordas	5W	4D
VDS	/xcxx	Vordas	4W	4D
WWD		Wellwood	1	1
WWB		Willowbend	6WI	4SD
WWB	/xxxs	Willowbend	6W	4D
WWC		Willowcrest	3M	3SD
WWC	/oxxx	Willowcrest	3ME	3SD
WWC	/1xxx	Willowcrest	3ME	3SD
WWC	/2xxx	Willowcrest	3ME	3SD
WWC	/3xxx	Willowcrest	4EM	3SD
WWC	/xcxx	Willowcrest	3M	3SD
WWC	/ocxx	Willowcrest	3EM	3SD
WWC	/1cxx	Willowcrest	3ME	3SD
WWC	/xdxx	Willowcrest	3TM	3ST
XVI		Xavier		4D

Table 6. Areal Extent of Soils Mapped in North Norfolk Municipality Presented by Series and Series Breakdown by Modifier and Phase.

SOIL NAME	SERIES CODE	AREA (HECTARES)	PERCENT (OF TOTAL)	SERIES BREAKDOWN BY MODIFIER AND PHASE (MAP SYMBOL)	AREA (HECTARES)	PERCENT (OF TOTAL)
Almasippi	ASS	16 321.20	14.14	ASS xxxx	14 821.36	12.85
"				ASS oxxx	587.54	.51
"				ASS 1xxx	601.25	.52
"				ASS 2xxx	47.64	.04
"				ASS xcxx	153.43	.13
"				ASS ocxx	11.61	.01
"				ASS 1cxx	94.47	.08
"				ASS xdxx	3.90	.00
Arizona	AIZ	34.46	.03	AIZ xxxx	2.44	.00
"				AIZ xdxx	17.83	.02
"				AIZ 3dxx	14.19	.01
Aronet	ARN	155.77	.14	ARN xxxx	155.77	.14
Birkenhead	BKA	124.20	.11	BKA xxxx	11.36	.01
"				BKA xcxx	38.76	.03
"				BKA 2cxx	20.76	.02
"				BKA 2exx	53.32	.05
Blumenfeld	BNF	337.60	.29	BNF xxxx	266.26	.23
"				BNF xxxxp	40.11	.03
"				BNF xxxe	31.23	.03
Bone	BNE	238.28	.21	BNE xxxx	152.80	.13
"				BNE xcxx	67.38	.06
"				BNE 1dxx	18.10	.02
Charman	CXV	17.03	.01	CXV ocxx	17.03	.01
Danlin	DLN	43.89	.04	DLN xxxx	22.08	.02
"				DLN ocxx	11.89	.01
"				DLN xdxx	9.92	.01
Deadhorse	DHO	388.43	.34	DHO xxxx	388.43	.34
Denham	DNH	30.36	.03	DNH xxxx	12.80	.02
"				DNH xcxx	17.56	.01
Dobbin	DOB	7 353.25	6.37	DOB xxxx	505.97	.44
"				DOB xcxx	2 545.49	2.20
"				DOB ocxx	130.79	.11
"				DOB 1cxx	484.82	.42
"				DOB 2cxx	11.23	.01
"				DOB 3cxx	13.23	.01
"				DOB xdxx	1 525.33	1.32
"				DOB odxx	14.65	.01
"				DOB 1dxx	356.23	.31
"				DOB 2dxx	207.43	.18
"				DOB 3dxx	5.57	.00
"				DOB xexx	621.84	.54
"				DOB oexx	110.94	.10
"				DOB 1exx	213.26	.19
"				DOB 2exx	118.50	.10
"				DOB 3exx	36.31	.03
"				DOB xfxx	273.57	.24
"				DOB 1fxx	111.97	.10
"				DOB 2fxx	66.12	.06
Edkins	EDK	69.44	.06	EDK xxxx	48.28	.04
"				EDK xxxxp	21.16	.02
Eigenhof	EGF	98.02	.09	EGF xxxx	98.02	.09
Elm Creek	EEK	337.97	.29	EEK xxxx	337.97	.29
Eroded Slope Complex	ERX	1 075.80	.93	ERX xxxx	1 075.80	.93
Fairland	FND	23.74	.02	FND xxxx	11.39	.01
"				FND xcxx	12.35	.01
Firdale	FIR	6 045.27	5.24	FIR xxxx	1 220.36	1.06
"				FIR xcxx	280.43	.24
"				FIR ocxx	52.89	.05
"				FIR 1cxx	7.29	.01
"				FIR xdxx	190.10	.16
"				FIR 1dxx	81.17	.07

Table 6. Areal Extent of Soils Mapped in North Norfolk Municipality Presented by Series and Series Breakdown by Modifier and Phase.
(Cont'd)

SOIL NAME	SERIES CODE	AREA (HECTARES)	PERCENT (OF TOTAL)	SERIES BREAKDOWN BY MODIFIER AND PHASE (MAP SYMBOL)	AREA (HECTARES)	PERCENT (OF TOTAL)
Firdale	FIR			FIR 2dxx	5.76	.00
"				FIR 3dxx	8.16	.01
"				FIR xexx	210.01	.18
"				FIR 1exx	528.94	.46
"				FIR 2exx	250.02	.22
"				FIR 3exx	97.31	.08
"				FIR xfxx	361.78	.31
"				FIR 1fxx	839.27	.73
"				FIR 2fxx	1 386.72	1.20
"				FIR 3fxx	494.40	.43
"				FIR 2gxx	24.46	.02
"				FIR 3gxx	6.20	.01
Fortier	FTE	42.04	.04	FTE xxxx	42.04	.04
Gateside	GTD	7.58	.01	GTD xxxx	7.58	.01
Gervais	GVS	930.90	.81	GVS xxxx	923.44	.80
"				GVS xexx	7.46	.01
Glenboro	GBO	37.82	.03	GBO xcxx	37.82	.03
Gnadenthal	GDH	1 600.92	1.39	GDH xxxx	1 112.69	.97
"				GDH xxxe	474.74	.41
"				GDH 2cxx	13.49	.01
Grayeville	GYV	2 061.04	1.79	GYV xxxx	1 859.45	1.61
"				GYV xxxe	201.59	.18
Grover	GRO	-	.00	GRO xcxx	-	.00
Halstead	HAT	11 723.56	10.16	HAT xxxx	3 764.57	3.26
"				HAT 1xxx	185.36	.16
"				HAT 2xxx	28.96	.03
"				HAT xcxx	2 644.12	2.30
"				HAT ocxx	53.09	.05
"				HAT 1cxx	223.45	.19
"				HAT 2cxx	102.31	.09
"				HAT 3cxx	10.41	.01
"				HAT xdxx	662.92	.57
"				HAT odxx	7.67	.01
"				HAT 1dxx	155.55	.13
"				HAT 2dxx	119.50	.10
"				HAT 3dxx	139.89	.12
"				HAT xexx	493.36	.43
"				HAT oexx	28.72	.02
"				HAT 1exx	255.82	.22
"				HAT 2exx	523.82	.45
"				HAT 3exx	225.70	.20
"				HAT xfxx	488.72	.42
Halstead				HAT 1fxx	332.71	.29
"				HAT 2fxx	716.02	.62
"				HAT 3fxx	527.00	.46
"				HAT 3gxx	33.89	.03
Hibsin	HIN	10.67	.01	HIN xxxx	10.67	.01
Hummerston	HMO	93.65	.08	HMO xxxx	23.04	.02
"				HMO xcxx	70.61	.06
Jasset	JST	8.29	.01	JST xxxx	8.29	.01
Kronstal	KOT	383.32	.33	KOT xxxx	325.50	.28
"				KOT 1xxx	42.96	.04
"				KOT xcxx	14.86	.01
La Salle	LSL	24.93	.02	LSL xxxx	17.17	.01
"				LSL xcxx	7.76	.01
Lavenham	LVH	242.42	.21	LVH xxxx	230.46	.01
"				LVH xcxx	11.96	.20
Leary	LRY	17.00	.01	LRY xxxx	17.00	.01
Lelant	LLT	7 655.55	6.63	LLT xxxx	5 483.09	4.75
"				LLT oxxx	11.37	.01
"				LLT xxxxd	1 061.86	.92
"				LLT oxxxd	3.52	.00
"				LLT xxxxdp	119.92	.10

Table 6. Areal Extent of Soils Mapped in North Norfolk Municipality Presented by Series and Series Breakdown by Modifier and Phase.
(Cont'd)

SOIL NAME	SERIES CODE	AREA (HECTARES)	PERCENT (OF TOTAL)	SERIES BREAKDOWN BY MODIFIER AND PHASE (MAP SYMBOL)	AREA (HECTARES)	PERCENT (OF TOTAL)
Lelant	LLT			LLT xxxxp	871.95	.76
"				LLT xxxep	93.89	.08
"				LLT xxxe	9.95	.01
Long Plain	LOP	5 837.50	5.06	LOP xxxx	3 265.69	2.84
"				LOP oxxx	227.64	.20
"				LOP 1xxx	423.61	.37
"				LOP 2xxx	625.79	.54
"				LOP 3xxx	2.32	.00
"				LOP xcxx	905.81	.78
"				LOP ocxx	37.82	.03
"				LOP 1cxx	180.56	.16
"				LOP 2cxx	156.83	.14
"				LOP xdxx	3.20	.00
"				LOP xexx	4.27	.00
"				LOP xfxx	3.96	.00
Marsh Complex				MHC	1 073.28	.93
				MHC xxxx	1 073.28	.93
Mockry	MKY	237.13	.21	MKY xxxx	158.11	.14
"				MKY xxxxp	79.02	.07
Neuenberg	NBG	2 548.42	2.21	NBG xxxx	1 674.28	1.45
"				NBG xxxxe	801.61	.70
"				NBG oxxx	72.53	.06
Neuhorst	NUH	826.15	0.72	NUH xxxx	524.61	.46
"				NUH xxxxe	301.54	.26
Newton Siding	NWN	13.78	.01	NWN xxxx	13.78	.01
Oberon	OBR	17.33	.02	OBR xxxx	17.33	.02
Onahan	ONH	478.14	.41	ONH xxxx	132.26	.11
"				ONH xcxx	318.26	.27
"				ONH xexx	20.65	.02
"				ONH xfxx	6.97	.01
Osborne	OBO	550.04	.48	OBO xxxx	550.04	.48
Osterwick	OWK	78.47	.07	OWK xxxx	78.47	.07
Perillo	PER	791.96	.69	PER xxxx	791.96	.69
Petrel	PTR	48.94	.04	PTR xxxx	48.94	.04
Pleasant	PLE	35.11	.03	PLE xxxx	29.40	.03
"				PLE xcxx	5.71	.00
Plum Coulee	PME	473.34	.41	PME xxxx	473.34	.41
Poolex	POX	424.94	.37	POX xxxx	415.14	.36
"				POX xxxxp	9.80	.01
Prodan	PDA	46.90	.04	PDA xxxx	21.96	.02
"				PDA xcxx	24.94	.02
Prosser	PSE	16.42	.01	PSE xxxx	16.42	.01
Ramada	RAM	59.04	.05	RAM xxxx	59.04	.05
Rathwell	RWL	188.96	.16	RWL xxxx	100.70	.08
"				RWL xxxe	88.26	.08
Red River	RIV	168.13	.15	RIV xxxx	168.13	.15
Reinfeld	RFD	105.97	.09	RFD xxxx	105.97	.09
Reinland	RLD	3 125.18	2.71	RLD xxxx	2 975.37	2.58
"				RLD xxxe	25.70	.02
"				RLD oxxx	39.64	.03
"				RLD 1xxx	8.30	.01
"				RLD 2xxx	22.85	.02
"				RLD 1cxx	53.32	.05
Rignold	RGD	1 269.57	1.10	RGD xxxx	1 269.57	1.10
Rosebank	RBK	1 336.76	1.16	RBK xxxx	1 086.69	.94
"				RBK xxxe	204.85	.18
"				RBK oxxx	45.22	.04
St. Claude	SUE	12 305.90	10.66	SUE xxxx	11 696.66	10.14
"				SUE xxxxe	129.85	.11
"				SUE xxxxt	7.68	.01
"				SUE oxxx	314.40	.27
"				SUE 1xxx	132.49	.11

Table 6. Areal Extent of Soils Mapped in North Norfolk Municipality Presented by Series and Series Breakdown by Modifier and Phase.

(Cont'd)

SOIL NAME	SERIES CODE	AREA (HECTARES)	PERCENT (OF TOTAL)	SERIES BREAKDOWN BY MODIFIER AND PHASE (MAP SYMBOL)	AREA (HECTARES)	PERCENT (OF TOTAL)
St. Claude	SUE			SUE xcxx	24.82	.02
Scanterbury	SCY	183.19	.16	SCY xxxx	183.19	.16
Sewell	SEE	397.19	.34	SEE xxxx	181.33	.16
"				SEE xxxxp	215.48	.18
"				SEE xdxx	.38	.00
Shellmouth	SEU	303.31	.26	SEU xxxx	10.87	.01
"				SEU xexx	48.41	.04
"				SEU xfxx	181.61	.16
"				SEU 3fxx	13.91	.01
"				SEU xgxx	48.51	.04
Shilox	SHX	6 065.47	5.26	SHX xxxx	32.18	.03
"				SHX xcxx	182.57	.16
"				SHX xdxx	1 623.66	1.41
"				SHX xexx	2 209.68	1.92
"				SHX 1exx	61.99	.05
"				SHX 3exx	23.62	.02
"				SHX xfxx	1 853.92	1.61
"				SHX 1fxx	13.99	.01
"				SHX 3fxx	26.14	.02
"				SHX xgxx	37.72	.03
Skelding	SKL	413.67	.36	SKL xxxx	18.50	.02
"				SKL xcxx	239.50	.20
"				SKL xdxx	88.52	.08
"				SKL xfxx	67.15	.06
Squirrel Creek	SQR	181.46	.16	SQR xxxx	146.40	.13
"				SQR xxxxs	35.06	.03
Stockton	SCK	228.43	.20	SCK xxxx	80.64	.08
"				SCK xcxx	61.11	.05
"				SCK odxx	21.05	.02
"				SCK 2dxx	16.52	.01
"				SCK 3exx	49.11	.04
Tadpole	TDP	318.61	.28	TDP xxxx	238.36	.21
"				TDP xxxxp	80.25	.07
Taggart	TGR	20.32	.02	TGR xxxx	20.32	.02
Torcan	TOC	16.31	.01	TOC xxxx	16.31	.01
Vordas	VDS	70.71	.06	VDS xxxx	61.51	.05
"				VDS xcxx	9.20	.01
Wellwood	WWD	12.52	.01	WWD xxxx	12.52	.01
Willowbend	WWB	1 119.99	.97	WWB xxxx	1 104.32	.96
"				WWB xxxxs	15.67	.01
Willowcrest	WWC	14 603.49	12.66	WWC xxxx	9 756.41	8.45
"				WWC oxxx	2 066.84	1.79
"				WWC 1xxx	2 251.76	1.95
"				WWC 2xxx	65.14	.06
"				WWC 3xxx	12.99	.01
"				WWC xcxx	102.03	.09
"				WWC ocxx	42.83	.04
"				WWC 1cxx	298.39	.26
"				WWC xdxx	7.10	.01
Xavier	XVI	1 704.64	1.48	XVI xxxx	1 704.64	1.48
TOTALS	73	115 231.07*	99.89	235	115 231.07*	99.89

* Non-soil not included

4.3.2 Soil Suitability Subclasses

The basic soil properties that singly or in combination with others commonly affect soil suitability for selected engineering properties and recreation uses are provided in Table 7. These subclass designations serve to identify the kind of limitation or hazard for a particular use.

4.3.3 Guides for Assessing Soil Suitability

Guides for assessing soil suitability for ten engineering related uses are given in Appendix D, Tables 12 to 21. These tables provide as specifically as possible, definitions of the soil properties which result in the specific suitability or degree of limitation. In assessing soil suitability for various engineering uses, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed soil properties. For example, if the suitability is "Good" for all but one soil property and it is estimated to be "Very Poor", then the overall rating of the soil for that selected use is "Very Poor". Suitability of individual soil properties, if estimated to be "Fair" or "Poor", can be accumulative in their effect for a particular use. Judgement is required to determine whether the severity of the combined effects of several soil properties on suitability for a particular use will result in downgrading an evaluation. This is left to the discretion of the interpreter. It is incorrect to assume that each of the major soil properties influencing a particular use has an equal effect. Class limits established for rating the suitability of individual soil properties take this into account. For a selected use, therefore, only those soil properties which most severely limit that use are specified.

Engineering description of the soils and their estimated properties significant to engineering are provided in Table 8. These data, in addition to information contained in other sections of the report have been used to rate the soils according to their suitability for ten selected engineering uses in Table 9. When using these interpretations, consideration must be given to the following assumptions:

1. Interpretations are based on predictions of soil behavior under defined conditions of use and management as specified in the preamble to each of Tables 12 through 25 (Appendix D).

2. Soil ratings do not include site factors such as nearness to towns and highways, water supply, aesthetic values, etc.

3. Soil ratings are based on natural, undisturbed soil.

4. Soil suitability ratings are usually given for the entire soil, but for some uses, they may be based on the limitations of an individual soil horizon or other earthy layer, because of its overriding importance. Ratings rarely apply to soil depths greater than 1 to 2 meters, but in some kinds of soils, reasonable estimates can be given for soil material at greater depths. It should be noted here that the term "soil" has been used throughout the report in the pedologic sense and differs in concept from that commonly used by engineers.

5. Poor and very poor soil ratings do not imply that a site cannot be changed to remove, correct or modify the soil limitations. The use of soils rated as poor depends on the nature of the limitations, whether or not the soil limitation can be altered successfully and economically, and on the scarcity of good sites.

6. Interpretations of map units do not eliminate the need for on-site evaluation by qualified professionals. Due to the variable nature of soils, and the scale of mapping, small, unmappable inclusions of soils with different properties may be present in an area where a development is planned. The need for or importance of on-site studies depends on the use to be made of the soil and the kinds of soil and soil problems involved.

4.4 SOIL SUITABILITY FOR SELECTED RECREATION USES

This section provides interpretations of the soil suitability for recreational development. All types of soil can be used for recreational activities of some kind.

Soils and their properties determine to a large degree, the type and location of recreational facilities. Wet soils are not suitable for campsites, roads, playgrounds or picnic areas. Soils that pond and dry out slowly after heavy rains present problems where intensive use is contemplated. It is difficult to maintain grass cover for playing fields and golf courses on droughty soils. The feasibility of many kinds of outdoor activities are determined by other basic soil properties such as depth to bedrock, stoniness, topography or land pattern, and the ability of the soil to support vegetation of different kinds as related to its natural fertility.

The suitability of the various soil series and phases for selected recreation uses is shown in Table 10 according to four classes, Good, Fair, Poor and Very poor defined previously in the section on Engineering Uses. Subclasses are employed to identify the kind of limitation or hazard for a particular use. An explanation of subclass symbols are provided in Table 7.

The guidelines for various recreation uses are presented in Appendix D, Tables 22 to 25.

Table 7. Codes utilized to identify limitations in evaluating soil suitability for selected Engineering and Recreational Uses (Tables 9 and 10)

a	subgrade properties
b	thickness of topsoil
c	coarse fragments on surface
d	depth to bedrock
e	erosion or erodibility
f	susceptibility to frost hazard
g	contamination hazard of groundwater
h	depth to seasonal water table
i	flooding or inundation
j	thickness of slowly permeable material
k	permeability or hydraulic conductivity
l	shrink-swell properties
m	moisture limitations or deficit
n	salinity or sulphate hazard
o	organic matter
p	stoniness
q	depth to sand or gravel
r	rockiness
s	surface texture
t	topographic slope class
u	moist consistence
w	wetness or soil drainage class
z	permafrost

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
ASS	Almasippi	0-20	LFS-FS	SM	A-2-4	100	90-100	<35	12.5-25.0	7.4-7.6	<0.3	low	low	0.8
		20-60	FS-LFS	(SW) SM	A-2-4	100	100	<35	12.5-25.0+	7.4-8.2	1.6	mod.	low	
		60-120	FS	(SW) SM	A-2-4,A-3	100	100	<35	12.5-25.0+	7.4-8.2	1.6	mod.	low	
AIZ	Arizona	0-25	FS-LFS	SM	A-3,A-2-4	100	90-100	5-25	12.5-25.0	7.4-7.80	<0.3	low	low	>2
		25-100	FS	SM to SP	A-2-4,A-3	100	90-100	3-15	15.0-25.0	7.4-7.8	<0.3	low	low	
ARN	Aronet	0-65	FS-LFS	SM	A-2-4	100	90-100	<35	12.5-25.0	7.0-7.6	<0.3	low	low	>1.5
		65-110	FS-LFS	(SW) SM	A-2-4,A-3	100	100	<35	12.5-25.0	7.0-7.6	<0.3	low	low	
BKA	Birkenhead	0-35	FS	SM to SP	A-2-4	100	70-85	5-15	15.0-25.0+	7.6	0.4	low	low	>1.2
		35-60	S	SM to SP	A-2-4	95-100	70-85	5-15	15.0-25.0+	7.8	0.4	low	low	
		60-70	S-FS	SM to SP	A-2-4	95-100	70-85	5-15	15.0-25.0+	7.9	0.3	low	low	
		70-90	LS	SM to SP	A-2-4	95-100	70-85	5-15	15.0-25.0+	7.9	0.3	low	low	
		90-120	FS	SM to SP	A-2-4	95-100	70-85	5-15	15.0-25.0+	7.9	0.3	low	low	
BNF	Blumenfeld	0-45	L	CL to OL	A-6	100	98-105	5-75	2.5-5.0	8.0	0.7	mod.	mod.	at surface
		45-80	VFSL-CL	CL to ML	A-6,A-4	100	98-100	55-75	2.5-5.0	8.0	1.6	mod.	mod.	
		80-120	L-CL	CL to ML	A-6,A-4	100	98-100	50-75	2.5-5.0	8.0	>1.6	mod.-high		
BNE	Bone	0-60	FSL-VFSL	SM to ML	A-2-4,A-4	100	100	30-75	0.5-2.0	7.4-7.8	1.0	low	mod.	0.8
		60-90	VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.8-8.2	1.0	low	mod.	
		90+	strat. VFS-FSL	SM-ML	A-2-4,A-4	100	100	30-75	0.5-2.0	7.8-8.2	1.6	mod.	mod.	
CXV	Charman	0-20	CL	CL	A-7-6	100	100	90-100	<1.5	7.4-7.8	<0.5	low	mod.	1.2
		20-80	SiCL	CL	A-7-6	100	100	90-100	<1.5	7.8-8.2	<0.5	low	mod.	
		80-100	SiL-SiCL	CL	A-6,A-7-6	100	100	90-100	0.1-5.0	7.8-8.4	<0.5	low	mod.	
DLN	Danlin	0-40	CL	CL	A-7-6	100	100	90-100	<1.5	7.4-7.8	<0.5	low	mod.	1.2
		40-70	SiCL-SiC	CL to MH	A-6,A-7-6	100	100	95-100	<0.2	6.8-7.2	<0.2	low	mod.	
		95-110	SiL	CL to ML	A-6,A-4	100	100	95-100	0.5-2.0	7.8-8.2	<0.5	low	low-mod.	
DHO	Deadhorse	0-30	C-SiC	OH	A-7-6	100	100	90-100	0.03-2.5	6.5-7.4	<2.0	low	high	0.8
		30-60	C-SiC	CH to MH	A-7-6	100	100	90-100	0.03-2.5	7.4-8.0	>2.0	low-mod.	high	
		60-120	C-SiC	CH to MH	A-7-6	100	100	90-100	0.03-2.5	8.0-8.2	>2.0	high	high	
DNH	Denham	0-30	L-CL	OL	A-4,A-6	100	100	85-100	1.5-5.0	6.8-7.4	<0.5	low	low-mod.	>1.5
		30-90	VFSL-CL	ML to CL	A-4,A-6	100	100	85-100	1.5-5.0	7.0-7.4	<0.5	low	low-mod.	
		90-110	C	CH	A-7-6	100	100	90-100	0.5	7.8-8.2	<0.5	low	high	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
DOB	Dobbin	0-35	LFS	SM to SP	A-2-4	100	85-95	5-35	15.0-25.0	6.5-7.3	<0.2	low	low	>2
		35-80	LFS	SM to SP	A-2-4	100	95-100	20-30	13.0-25.0	7.0-7.4	<0.2	low	low	
		80-110	FS-VFSL	SM to ML	A-2-4,A-4	100	100	60-70	1.5-5.0	7.4-7.8	<0.2	low	low	
EDK	Edkins	0-35	L	OL	A-4,A-6	100	100	55-75	3.5-5.0	6.8-7.4	<1.6	mod.	mod.-high	at or near surface
		35-85	FSL-SCL	CL to MH	A-6	100	100	60-70	3.5-5.0	7.8-8.0	<1.6	mod.	mod.-high	
		85-110	C	CH to MH	A-7-6	100	100	100	<0.1	7.8-8.0	>2.0	high	high	
EGF	Eigenhof	0-30	CL	CL to MH	A-7-6	100	100	75-100	0.2-1.0	6.5-7.4	<0.5	low	mod.-high	2.0
		30-60	CL-SiC	CL to MH	A-7-5	100	95-100	75-95	1.0-2.0	7.1-7.3	<0.5	low	mod.-high	
		60-120	CL	CL to MH	A-7-5	100	95-100	75-95	0.2-1.0	7.6-7.8	<1.6	mod.	mod.	
EEK	Elm Creek	0-30	FS	SM	A-2-4	100	90-100	1-10	5.0-12.0	6.5-7.4	<0.5	low	low	0.8
		30-90	LFS-LVFS	SM to ML	A-2-4,A-4	100	90-100	40-60	5.0-12.0	7.0-7.6	<0.5	low	low	
		90-110	C	CH,MH	A-7-6	100	100	100	<0.1	7.8-8.2	<1.6	low-mod.	high	
ERX	Eroded Slopes Complex	30-120	L-CL	CL	A-6	80-90	70-90	-	.05-.5	7.8-8.2	low	low	mod.	possible seepage lower
FND	Fairland	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.0-7.4	<0.2	low	mod.	>2
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.8-8.4	<0.2	low	mod.	
		60-100	SiL	ML	A-4	100	100	95-100	1.5-5.0	7.8-8.4	<0.3	low	mod.	
FIR	Firdale	0-40	CL	CL	A-7-6	100	100	90-100	0.5-2.0	6.6-7.3	<1.6	low	mod.	>2
		40-60	SiC	CL,MH	A-6,A-7-6	100	100	95-100	0.2	6.6-7.3	<0.2	low	mod.	
		60-110	SiCL	CL	A-6	100	100	95-100	0.5-2.0	6.6-7.3	<0.3	low	mod.	
		110+	SiL	CL,ML	A-6,A-4	100	100	95-100	0.5-2.0	7.4-7.8	<0.3	low	mod.	
FTE	Fortier	0-25	SiC-C	OH	A-7-6	100	100	95-100	0.1-0.25	7.4-8.2	>1.6	high	high	0.8
		25-85	SiC-C	MH	A-7-6	100	100	95-100	0.1-0.25	7.8-8.2	>1.6	high	high	
		85-110	FS-LVFS	SM to ML	A-2,A-4	100	100	15-70	5.0-12.0	7.8-8.2	>1.6	high	low	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification USDA	Unified	AASHO	% Passing Sieve No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm	Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
GTD	Gateside	0-60	FSL-VFSL	SM to ML	A-2-4,A-4	100	100	30-75	0.5-2.0	7.4-7.8	1.0	low	low	0.8
		60-90	VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.8-8.4	<0.5	low	low	
		90+	strat. VFS-L	SM to ML	A-2-4,A-4	100	100	30-75	1.5-2.0	7.8-8.4	<1.6	low-mod.	low	
GVS	Gervais	0-25	SiL-SiCL	MH	A-7-6	100	100	90-100	0.5-5.0	6.8-7.4	<0.5	low	mod.	flood prone
		25-100	VFSL-SiCL	ML to CL	A-4,A-6	100	100	90-100	0.5-5.0	7.6-8.2	<1.6	low-mod.	mod.	
GBO	Glenboro	0-40	L-VFSL	ML to CL	A-4,A-6	100	100	80-90	1.5-5.0	7.0-7.4	-	low	mod.	1.5
		40-90	LFS-L	SM to ML	A-2,A-4	100	90-100	30-90	0.5-2.5	7.4-7.8	-	low	mod.	
			strat.											
		90+	FS-LFS	SM to SP	A-2,A-4	100	85-95	5-40	1.5-5	7.8-8.4	-	low	low	
GDH	Gnadenthal	0-30	L	OL	-	100	100	55-75	1.5-5	6.8-7.4	0.5-1.6	low-mod.	mod.	0.8
		30-60	VFSL-L	ML to CL	A-4,A-6	100	95-100	65-75	1.5-5	8.0-8.2	0.5-1.6L	low-mod.	mod.	
		60-120	VFSL-SiCL	ML to CL	A-4,A-6	100	95-100	65-75	0.5-5	8.0-8.2	>1.6	high	mod.	
GYV	Graysville	30-90	VFSL-CL	ML to CL	A-5,A-7-6	100	100	65-80	2.5-6.5	7.6-8.2	<1.6	mod.	mod.	0.8
		90-100	C	CH to MH	A-7-6	100	100	95-100	.03-.1	7.8-8.2	>1.6	mod.-	high	
GRO	Grover	0-40	L-SCL	ML to CL	A-4,A-6	100	100	80-90	1.5-5	7.4-7.8	-	low	mod.	seasonal 0.7
		40-90	LFS-L	SM to ML	A-2,A-4	100	90-100	30-90	1.5-5	7.8-8.4	-	low	mod.	
			strat.						5-40					
		90+	FS-LFS	SM to SP	A-2,A-4	100	85-95	1.5-5	7.8-8.4	-		low		low
HAT	Halstead	0-55	VFS-FSL	ML to CL	A-2-4,A-4	100	100	30-75	1.5-5.0	7.4-7.6	<0.2	low	mod.	>2
		55-150	VFSL	ML	A-4	100	100	75-85	1.5-5.0	7.4-7.8	<0.2	low	mod.	
		150+	L	ML to CL	A-4	100	100	90-95	1.5-5.0	7.4-7.8	<0.3	low	mod.	
HIN	Hibsin	0-30	FS	SM	A-2-4	100	90-100	1-10	5.0-12.0	6.5-7.4	<0.5	low	low	>1.5
		30-85	VFS-FSL	SM to SP	A-2,A-4	100	90-100	25-70	5.0-12.0	7.2-7.6	<0.5	low	low	
		85-100	SiC-C	CH to MH	A-7-6	100	100	95-100	0.1-0.25	7.8-8.2	<1.6	low-mod.	high	
HMO	Hummerston	0-20	LFS-FSL	SM to SP	A-2,A-4	95-100	85-95	5-40	6.0-12.5	7.3-7.6	<1.6	low	low	0.8
		20-100	FS-LFS	SM to SP	A-2-4	95-100	80-95	5-35	6.0-12.5	7.6-8.0	<1.6	low-mod.	low	
JST	Jasset	30-80	VFSL-L	ML to CL	A-5	100	95-100	65-75	2.6	7.0-7.4	<0.5	low	mod.	1.2
		80-110	FS-LVFS	SM to ML	A-2,A-4	100	100	15-70	5-12	7.8-8.2	<1.6	low-mod.	low	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
KOT	Kronstal	0-40	FSL	SM	A-2,A-4	100	95-100	5-35	5.0-15.0	6.5-7.4	<0.5	low	low	
		40-90	VFS-FSL	ML to SM	A-4,A-2-4	100	100	25-60	5.0-15.0	7.0-7.4	<0.5	low	low	1.2
		90-110	FS-LFS	SM to SW	A-2-4,A-3	100	95-100	15-35	15.0-35.0	7.8-8.2	<1.6	low-mod.	low	
LSL	La Salle	0-30	SiC-SiCL	MH to OH	A-7-6	100	100	90-100	0.5-5.0	6.8-7.4	<0.2	low	mod.	flood
		30-60	FSL-SiC-SiCL		SM to CL	A-4,A-7-6		100	100	65-100	0.5-5.0	7.4-8.2	<0.2	lowmod.prone
		60-120	FSL-SiL-SiCL	SM to CL	A-4,A-7-6	100	100	65-100	0.5-5.0	7.4-8.2	<1.6	low-mod.	mod.	
LVH	Lavenham	0-25	LFS	SM	A-2-4	100	90-100	10-25	15-25	7.0-7.4	low	low	low	seasonal
		25-50	FS-LFS	SM	A-3,A-2-4	100	90-100	5-25	15-25	7.6-7.8	low	low	low	0.8
		50-100	FS	SM	A-3,A-2-4	100	90-100	3-15	5-15	7.6-8.0	low	low	low	
LRY	Leary	0-25	LFS	SM	A-2	85-100	90-100	10-20	15-25	7.4 7.8	<0.5	low	low	>2
		25-75	GrLS-FGr	GW or GP	A-1	35-60	-	<5	>25	7.8-8.4	<0.5	low	low	
LLT	Lelant	0-30	FSL	OL	-	100	100	15-50	12.5-25.0	7.0-7.4	<1.6	low-mod.	low	at
		30-60	FS-FSL	SM,ML	A-2-4	100	100	10-50	12.5-25.0	7.4-8.2	<1.6	low-mod.	low	surface
		60-120	FS-LFS	SM(SW)	A-2-4	100	100	5-35	12.5-25.0	7.4-8.2	<1.6	low-mod.	low	
LOP	Long Plain	0-25	FS-LFS	SM	A-2-4	100	100	1-10	15.0-35.0	6.8-7.4	<0.5	low	low	
		25-70	LFS-FS	SM	A-2-4	100	100	5-35	15.0-35.0	7.0-7.4	<0.5	low	low	1.2
		70-110	FS	SM(SW)	A-2-4,A-3	100	100	5-35	15.0-35.0	7.8-8.2	<0.5	low	low	
MHC	Marsh Complex	0-15	peaty	Pt	-	-	-	-	-	7.5-8.2	<2	low-mod.	-	above
		15-100	var.	var.	var.	-	-	-	-	7.5-8.2	<6	low-mod.	var.	surface
MKY	Mockry	0-20	LFS-FS	SM to SP	A-2-4	100	80-100	10-35	-	7.6-8.0	<1.6	low-mod.	low	at
		20-100	FS-LFS	SW to SM	A-3,A-2-4	100	80-100	8-35	-	7.8-8.4	<1.6	low-mod.	low	surface
NBG	Neuenberg	0-40	L	OL to ML	A-4,A-7-5	100	100	55-75	1.5-5.0	6.8-7.4	1.6	mod.	low	
		40-90	VFSL-L	ML to CL	A-4,A-6	100	100	40-60	1.5-5.0	7.6-8.0	1.6	mod.	low-mod.	1.0
NBG	Neuenberg	0-120	FS-LVFS	SM to ML	A-2-4,A-4	100	100	50-75	5.0-15.0	7.8-8.2	>1.6	mod.-high		
NUH	Neuhorst	30-70	CL,SiCL	CL to CH	A-7-5,A-7-6	100	100	70-90	.5-5	7.8-8.2	1.6	mod.	mod.	1.2
		10-110	strat.SiL-CL	ML to CL	A-4,A-6	100	100	70-90	.5-5	7.8-8.2	>1.6	mod.-high	mod.	
NWN	Newton Siding	0-20	CL	ML	A-7-6	100	100	90-100	0.5-1.5	7.2-7.6	0.5-1.5	low-mod.	mod.	
		20-80	CL	ML	A-7-6	100	100	90-100	0.5-1.5	7.2-7.6	0.5-1.5	low-mod.	mod.	1.0
		80-120	FS-VFS	SM	A-2-4,A-4	100	100	40-70	5-15	7.6-8.2	1.5-4	mod.	low	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Sym-bol	Soil Series Name	Depth (cm)	Textural Classification USDA	Unified	AASHO	% Passing Sieve No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm	Disturbed Hydraulic Conduc-tivity (cm/hr)	Reaction (pH)	Elec-trical Conduc-tivity (mS/cm)	Sulphate Hazard	Shrink-Swell Poten-tial	Depth to Seasonal Water Table (m)
OBR	Oberon	0-25	SCL-CL	CL	A-6	100	100	60-80	1.5-5.0	7.2-7.6	low	low	mod.	seasonal
		25-75	SCL-CL	CL	A-6	100	100	60-80	1.5-5.0	7.6-8.0	low	low	mod.	0.8
		75-100	LFS-FS	SM,Sp,ML		A-2 to A-4		100	100	5-50	6.-12.	7.8-8.4	low	lowlow
ONH	Onahan	0-20	LFS-FS	SW to SP	A-2-4	100	80-100	10-35	12.5-25.0	6.8-7.2	<0.3	low	low	0.8
		20-100	LFS-FS	SW to SP	A-3,A-2-4	100	80-100	7-35	12.5-25.0	7.8-8.2	<0.3	low	low	
OBO	Osborne	0-35	C	OH	A-7-6	100	100	100	0.15	6.5-7.4	<1.6	mod.	high	near surface
		35-100	C	CH	A-7-6	100	100	100	0.15	7.8-8.2	<1.6	mod.	high	
OWK	Osterwick	0-60	FSL	SM	A-2,A-4	100	95-100	5-35	5.0-15.0	6.5-7.4	<0.5	low	low	near surface
		60-100	FSL	SM	A-4	100	100	35-60	7.5-10.0	8.0-8.2	<1.6	low-mod.	low	
		100-140	FS-FSL	SM to ML	A-4,A-2-4	100	100	35-60	1.0-5.0	8.0-8.2	<1.6	low-mod.	low	
PER	Perillo	0-60	OM	Pt	-	-	-	-	-	7.8-8.2	-	-	-	at surface
		60-85	FSL-SiL	OL	-	100	100	40-95	0.5-5.0	7.8-8.2	<1.6	mod.	-	
		85-125	FS-SiL	SM to ML	A-2-4,A-4	100	100	25-90	1.5-15.0	7.8-8.2	<1.6	mod.	low	
PTR	Petrel	0-40	L-SCL	ML,CL	A-4,A-6	100	100	80-90	1.5-5	7.0-7.4	-	low	mod.	seasonal
		40-90	strat.	SM,ML	A-2,A-4	100	90-100	30-90	0.5-5	7.4-7.8	-	low	mod.	0.8 to 1
		90-100+	FS-LFS	SM,SP	A-2-4	100	85-95	5-35	13-25	7.8-8.4	-	low	low	
PLE	Pleasant	0-60	FSL-VFSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.4-7.8	<1.6	low-mod.	mod.	0.8
		60-90	VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.8-8.2	<1.6	low-mod.	mod.	
		90+	strat. VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	0.5-2.0	7.8-8.2	1.6	mod.	mod.	
PME	Plum Coulee	30-60	C	CH	A-7-6	100	100	95-100	0.1-1.5	7.5-7.8	<1.6	low-mod.	high	1.2
		60-120	SiCL-C	MH to CH	A-7-6	100	100	90-100	0.25-1.5	7.8-8.0	>1.6	mod.-high	high	
POX	Poolex	0-20	FSL-L	ML to CL	A-4,A-6	100	100	60-85	1.5-5.0	7.6-8.0	<1.6	low-mod.	low	at surface
		20-60	VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.8-8.4	<1.6	low-mod.	low	
		60-100	strat. VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	0.5-2.0	7.8-8.4	1.6	mod.	low	
PDA	Prodan	0-30	CL	CL	A-7-6	100	100	90-100	1.5-5.0	7.6-8.0	<0.5	low	mod.	0.7
		30-60	CL-SiCL	CL	A-6,A-7-6	100	100	95-100	1.5-5.0	7.8-8.4	<0.5	low	mod.	
		60-100	VFSL-SiL	ML to CL	A-6	100	100	95-100	0.5-1.5	7.8-8.4	1.6	mod.	low-mod.	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Sym-bol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conduc-tivity (cm/hr)	Reaction (pH)	Elec-trical Conduc-tivity (mS/cm)	Sulphate Hazard	Shrink-Swell Poten-tial	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
PSE	Prosser	0-50	FSL-VFSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.0-7.4	<0.2	low	mod.	>2
		50-80	VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.4-7.8	<0.2	low	mod.	
		80-100	Strat.VFS-L	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.8-8.4	<0.3	low	mod.	
RAM	Ramada	0-20	CL	CL	A-7-6	100	100	90-100	0.5-2.0	7.3-7.8	<1.6	low-mod.	mod.	>2
		20-75	SiCL	CL	A-6,A-7-6	100	100	85-95	1.5-5.0	7.4-7.8	<0.2	low	mod.	
		75-100	L-SiCL	CL	A-6,A-7-6	100	100	80-90	0.5-2.0	7.8-8.4	<0.3	low	mod.	
RWL	Rathwell	30-70	CL,SiCL	CL to CH	A-7-5,A-7-6	100	100	70-90	.5-.5	7.8-8.2	1.6	mod.	mod.	1.2
		70-110	strat.SiL-CL	ML to CL	A-4,A-6	100	100	70-90	.5-.5	7.8-8.2	>1.6	mod.-high	mod.	
RIV	Red River	0-30	C	OH	A-7-6	100	100	100	0.1	6.5-7.4	<1.6	low-mod.	high	1.5 m
		30-100	C	CH	A-7-6	100	100	100	0.1	7.6-8.2	<1.6	low-mod.	high	
RFD	Reinfeld	0-50	L	OL	A-4,A-6	100	95-100	55-75	5.0-7.5	6.5-7.4	<0.5 low	low-mod.	>1.5	
		50-100	strat. VFSL-SiCL	ML to CL	A-4,A-6	100	100	70-95	0.2-5.0	7.8-8.2	<1.6	low-mod.	low-mod.	
RLD	Reinland	0-30	FSL	SM	A-2,A-4	100	95-100	5-35	7.0-15.0	6.5-7.4	<1.6	low-mod.	low	>1.2
		30-75	FSL-LVFS	SM to ML	A-2-4,A-4	100	95-100	30-85	7.0-15.0	7.8-8.2	<1.6	low-mod.	low	
		75-110	FS-LVFS	SM to ML	A-2-4,A-4	100	95-100	25-75	7.0-20.0	7.8-8.2	1.6	mod.	low	
RGD	Rignold	0-40	L	OL	A-4,A-6	100	95-100	55-75	5.0-7.5	6.5-7.4	<0.5	low	low-mod	0.8 (perched)
		40-90	VFSL-CL	ML to CL	A-4,A-6	100	100	70-100	3.0-10.0	7.4-8.0	<0.5	low	mod.	
		90-110	C	CH to MH	A-7-6	100	100	100	<0.1	7.8-8.2	<1.6	low-mod.	high	
RBK	Rosebank	0-30	FS	SM	A-2-4	100	90-100	1-10	5.0-12.0	6.5-7.4	<0.5	low	low	0.8
		30-85	LFS-LVFS	SM to ML	A-2-4,A-4	100	90-100	40-60	5.0-12.0	7.8-8.2	<1.6	low-mod.	low	
		85-110	C,SiC	CH to MH	A-7-6	100	100	95-100	0.1	7.8-8.2	<1.6	low-mod.	high	
SUE	St. Claude	0-25	L-CL	SM	A-4,A-5	100	100	25-40	1.0-5.0	7.4-8.2	1.6	low	low	0.8
		25-75	SiL-L	ML	A-4	100	95-100	40-70	0.5	8.0-8.2	1.6	mod.-high	low	
		75-110	FS-LFS	SM	A-2-4,A-3	100	85-100	5-35	7.0-20.0	7.8-8.2	1.6	mod.	low	
SCY	Scanterbury	0-25	C	OH	A-7-6	100	100	90-100	<0.5	6.6-7.0	-	low	high	1.5
		25-60	C	CH	A-7-6	100	100	90-100	<0.5	7.0-7.6	<0.3	low	high	
						100	100	90-100	<0.1	7.8-8.2	<1.6	low-mod.	high	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
SEE	Sewell	0-20	LFS-FSL	SM,SP	A-2-4,A-4	100	100	5-50	-	7.6-8.0	<1.6	low-mod.	low	at surface
		20-100	FS-LVFS	SM,SP, ML	A-2-4,A-4	100	100	5-50	-	7.8-8.4	<1.6	low-mod.	low	
SEU	Shellmouth Complex	No Data Available												
SHX	Shilox	0-20	LFS-FS	SM to SP	A-2-4	100	80-100	10-35	15.0-25.0	6.5-7.2	<0.1	low	low	>2
		20-100	FS-LFS-S	SW to SP	A-3,A-2-4	100	60-90	7-35	15.0-25.0	7.6-8.0	<0.1	low	lo	
SKL	Skelding	0-25	FS	SM	A-2-4	100	100	<10	>25.0	6.5-7.4	<0.1	low	low	>2
		25-100	FS	SM,SW	A-2,A-3	100	70-100	<10	>25.0	6.5-7.4	<0.1	low	low	
SQR	Squirrel Creek	0-25	L-CL	SM	A-4,A-5	100	100	25-40	1.0-5.0	7.4-8.2	1.6	low	low	0.8
		25-85	SiL-L	ML	A-4	100	95-100	40-70	<0.5	8.0-8.2	>1.6	high	low	
		85-110	C,SiC	CH to MH	A-7-6	100	100	100	<0.1	7.8-8.2	>1.6	high	high	
SCK	Stockton	0-30	LFS	SM to Sp	A-2-4	100	85-95	3-15	>25	6.8-7.2	low	low	low	>2
		30-100	FS-LS	SM to Sp	A-3,A-2-4	100	85-95	3-15	13-25	7.4-7.8	low	low	low	
TDP	Tadpole	0-30	CL	CL	A-7-6	100	100	90-100	-	7.6-8.0	<1.6	low-mod.	mod.	at surface
		30-60	CL-SiCL	CL	A-6,A-7-6	100	100	95-100	-	7.8-8.4	<1.6	low-mod.	mod.	
		60-100	strat. VFSL-SiL-SiCL	ML to CL	A-4,A-6	100	100	95-100	-	7.8-8.4	<1.6	low-mod.	mod.	
TGR	Taggart	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	0.5-1.5	7.6-8.0	<0.5	low	low	0.8
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	0.5-1.5	7.8-8.4	<0.5	low	low	
		60-100	SiL	ML	A-4	100	100	95-100	0.5-1.5	7.8-8.4	<1.6	low-mod.	low	
TOC	Torcan	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.0-7.4	<0.5	low	low	1.0
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.4-7.8	<0.5	low	low-mod.	
		60-100	SiL	ML	A-4	100	100	95-100	0.5-1.5	7.8-8.4	<1.6	low-mod.	low-mod.	
VDS	Vordas	0-25	SiL-CL	CL	A-6,A-7-6	100	100	95-100	-	7.6-8.0	<1.6	low-mod.	mod.	at surface
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	-	7.8-8.4	<1.6	low-mod.	mod.	
		60-100	SiL-L	ML	A-4,A-6	100	100	95-100	-	7.8-8.4	1.6	mod.	mod.	
WWD	Wellwood	0-40	SCL-CL	CL	A-6	100	100	60-80	1.5-5.0	7.0-7.4	-	low	mod.	>2
		40-85	SCL-CL	CL	A-6	100	100	60-80	1.5-5.0	7.8-8.4	-	low	mod.	
		85-100	FS-LVFS	SM,SP,ML		A-2,A-6	100	100	5-50	6-13	7.8-8.4	-	low	

Table 8. Engineering Description of Soils and their Estimated Properties Significant to Engineering Uses (Cont'd)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
WWB	Willowbend	0-35	L-CL	OL,OH	A-4,A-7	100	100	65-100	-	6.5-7.4	<1.6	low	low	flood prone
		35-100	strat. FS-SiCL	ML,CL	A-4,A-6	100	100	30-100	variable	7.8-8.2	<1.6	low-mod.	low-mod.	
WWC	Willowcrest	0-60	FS	SM	A-2-4	100	100	1-10	15.0-50.0	6.5-7.4	<1.6	low	low	1.0
		60-120	FS-LFS	SM,SW	A-2-4,A-3	100	100	5-35	15.0-50.0	7.8-8.2	<1.6	low-mod.	low	
XVI	Xavier	0-130	Om	Pt	-	-	-	-	-	7.8-8.2	1.6	mod.	at surface	
		130-150	FS-SL	SM,ML	A-2-4,A-4	100	100	25-90	1.5-15.0	7.8-8.2	1.6 mod.	low		

Table 9. Suitability Ratings of Soils for Selected Engineering Uses

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Perm. Bldgs. w/Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
ASS	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /oxxx	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /1xxx	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /2xxx	Almasippi	Pbs	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /xcxx	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /ocxx	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /1cxx	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
ASS /xdxx	Almasippi	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
AIZ	Arizona	Vb	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
AIZ /xdxx	Arizona	Vb	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
AIZ /3dxx	Arizona	Vb	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
ARN	Aronet	Ps	Pa	Va	G	Va	Vak	Vk	Fs	Vk	Gg
BKA	Birkenhead	Ps	G	G	G	G	Vks	Vk	Vs	Vka	Gg
BKA /xcxx	Birkenhead	Ps	G	G	G	G	Vks	Vk	Vs	Vka	Gg
BKA /2cxx	Birkenhead	Vb	G	G	G	G	Vks	Vk	Vs	Vka	Gg
BKA /2exx	Birkenhead	Vb	G	G	Ft	Ft	Vks	Vk	Vs	Vkt	Ftg
BNF	Blumenfeld	Fs	Va	Pw	Pw	Pw	Vw	Pw	Pw	Vh	Vh
BNFp	Blumenfeld	Fb*	Va	Vw	Vw	Vw	Vw	Vw	Vw	Vh	Vh
BNF /xxxs	Blumenfeld	Pn	Va	Pw	Pw	Pw	Vw	Pw	Pw	Vh	Vh
BNE	Bone	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Phk	Phg
BNE /xcxx	Bone	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Phk	Phg
BNE /1dxx	Bone	Ftb	Va	Faw	Pw	Faw	Pwk	Pk	G	Pkt	Phg
CXV /ocxx	Charman	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fkt	Ph
DLN	Danlin	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
DLN /ocxx	Danlin	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fkt	Ph
DLN /xdxx	Danlin	Fst	Va	Faw	Pw	Faw	Pw	Fw	Fs	Pt	Ph
DHO	Deadhorse	Ps	Va	Pa	Pwa	Pa	Psw	Fw	Ps	Fh	Pkh
DNH	Denham	Fs	Va	Fa	Pa	Fa	Ps	G	Fs	Fk	Pd
DNH /xcxx	Denham	Fs	Va	Fa	Pa	Fa	Ps	G	Fs	Fkt	Pd
DOB	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /xcxx	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /ocxx	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /1cxx	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /2cxx	Dobbin	Pbs	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /3cxx	Dobbin	Vb	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /xdxx	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /odxx	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /1dxx	Dobbin	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /2dxx	Dobbin	Pbs	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /3dxx	Dobbin	Vb	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
DOB /xexx	Dobbin	Pst	Pa	G	Ft	Ft	Vak	Vk	Fts	Vkt	Ftg
DOB /oexx	Dobbin	Pst	Pa	G	Ft	Ft	Vak	Vk	Fts	Vkt	Ftg
DOB /1exx	Dobbin	Pst	Pa	G	Ft	Ft	Vak	Vk	Fts	Vkt	Ftg
DOB /2exx	Dobbin	Pst	Pa	G	Ft	Ft	Vak	Vk	Fts	Vkt	Ftg
DOB /3exx	Dobbin	Vb	Pa	G	Ft	Ft	Vak	Vk	Fts	Vkt	Ftg
DOB /xfxx	Dobbin	Vt	Pa	Ft	Pt	Pt	Vak	Vk	Pt	Vkt	Ptg
DOB /1fxx	Dobbin	Vt	Pa	Ft	Pt	Pt	Vak	Vk	Pt	Vkt	Ptg
DOB /2fxx	Dobbin	Vt	Pa	Ft	Pt	Pt	Vat	Vk	Pt	Vkt	Ptg
EDK	Edkins	Fab	Va	Pw	Pw	Pw	Vw	Pw	Pw	G	Vh
EDKp	Edkins	Fb*	Va	Vw	Vw	Vw	Vw	Vwh	Vw	Fa	Vh
EGF	Eigenhof	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
EEK	Elm Creek	Ps	Pa	Fw	Paw	Fw	Pws	Pk	Fs	Fa	Pd
ERX	Eroded Slope Compl	Vt	Va	Pt	Vt	Vt	Pt	Vt	Vt	Vt	Vt
FND	Fairland	G	Va	Fa	Fa	Fa	G	G	G	Fak	Gg
FND /xcxx	Fairland	G	Va	Fa	Fa	Fa	G	G	G	Fat	Gg
FIR	Firdale	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
FIR /xcxx	Firdale	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
FIR /ocxx	Firdale	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
FIR /1cxx	Firdale	Fsb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
FIR /xdxx	Firdale	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
FIR /1dxx	Firdale	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
FIR /2dxx	Firdale	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk

Table 9. Suitability Ratings of Soils for Selected Engineering Uses (Cont'd)

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Perm. Bldgs. w/Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
FIR /3dxx	Firdale	Vb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
FIR /xexx	Firdale	Pt	Va	Fa	Fat	Fat	Fs	Pt	Fat	Vt	Fkt
FIR /1exx	Firdale	Pt	Va	Fa	Fat	Fat	Fs	Pt	Fat	Vt	Fkt
FIR /2exx	Firdale	Pt	Va	Fa	Fat	Fat	Fs	Pt	Fat	Vt	Fkt
FIR /3exx	Firdale	Vb	Va	Fa	Fat	Fat	Fs	Pt	Fat	Vt	Fkt
FIR /xfxx	Firdale	Vt	Va	Fat	Pt	Pt	Fat	Pt	Pt	Vt	Pt
FIR /1fxx	Firdale	Vt	Va	Fat	Pt	Pt	Fat	Pt	Pt	Vt	Pt
FIR /2fxx	Firdale	Vt	Va	Fat	Pt	Pt	Fat	Pt	Pt	Vt	Pt
FIR /3fxx	Firdale	Vbt	Va	Fat	Pt	Pt	Fat	Pt	Pt	Vt	Pt
FIR /2gxx	Firdale	Vt	Va	Pt	Vt	Vt	Pt	Vt	Vt	Vt	Vt
FIR /3gxx	Firdale	Vbt	Va	Pt	Vt	Vt	Pt	Vt	Vt	Vt	Vt
FTE	Fortier	Ps	Va	Pa	Paw	Pa	Pws	Pi	Ps	Vi	Phl
GTD	Gateside	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
GVS	Gervais	Pi	Va	Faw	Piw	Fiw	Piw	Pi	Fs	Pi	Phl
GVS /xexx	Gervais	Pib	Va	Faw	Piw	Fiw	Piw	Pi	Fis	Vit	Phi
GBO /xcxx	Glenboro	G	Pq	G	G	Fa	Vak	Gg	G	Vk	Gg
GDH	Gnadenthal	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Fk
GDH /xxxs	Gnadenthal	Pn	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Fk
GDH /2cxx	Gnadenthal	Fb	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Fk
GYV	Graysville	Fs	Va	Faw	Paw	Faw	Pew	Fw	Fs	Fk	Phd
GYV /xxxs	Graysville	Pn	Va	Faw	Paw	Faw	Pew	Fw	Fs	Fk	Phd
GRO /xcxx	Grover	G	Pq	Fw	Pw	Faw	Vak	Pk	G	Vk	Fhg
HAT	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /1xxx	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /2xxx	Halstead	Fb	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /xcxx	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /ocxx	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /1cxx	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /2cxx	Halstead	Fb	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /3cxx	Halstead	Vb	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
HAT /xdxx	Halstead	Ft	Va	Fa	Fa	Fa	Pk	Pk	G	Pkt	Gg
HAT /odxx	Halstead	Ft	Va	Fa	Fa	Fa	Pk	Pk	G	Pkt	Gg
HAT /1dxx	Halstead	Ft	Va	Fa	Fa	Fa	Pk	Pk	G	Pkt	Gg
HAT /2dxx	Halstead	Fb	Va	Fa	Fa	Fa	Pk	Pk	G	Pkt	Gg
HAT /3dxx	Halstead	Vb	Va	Fa	Fa	Fa	Pk	Pk	G	Pkt	Gg
HAT /xexx	Halstead	Pt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ptg
HAT /oexx	Halstead	Pt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ptg
HAT /1exx	Halstead	Pt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ptg
HAT /2exx	Halstead	Pbt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ptg
HAT /3exx	Halstead	Vb	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ptg
HAT /xfxx	Halstead	Vt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Ptg
HAT /1fxx	Halstead	Vt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Ptg
HAT /2fxx	Halstead	Vt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Ptg
HAT /3fxx	Halstead	Vbt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Ptg
HAT /3gxx	Halstead	Vbt	Va	Pt	Vt	Vt	Pk	Vt	Vt	Vt	Vt
HIN	Hibsin	Ps	Pa	Fa	Pa	G	Ps	Pk	Fs	Fs	Pd
HMO	Hummerston	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
HMO /xcxx	Hummerston	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
JST	Jaset	G	Paq	Fw	Pw	Faw	Vak	Pk	G	Vk	Fhg
KOT	Kronstal	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Fhg
KOT /1xxx	Kronstal	Fb	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Fhg
KOT /xcxx	Kronstal	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Fhg
LSL	La Salle	Fis	Va	Fa	Pi	Fia	Pi	Pi	Fs	Pi	Pi
LSL /xcxx	La Salle	Fis	Va	Fa	Pi	Fia	Pi	Pi	Fs	Pi	Pi
LVH	Lavenham	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
LVH /xcxx	Lavenham	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
LRY	Leary	Ps	G	G	G	G	Vak	Vk	Va	Vk	Gg
LLT	Lelant	Ps	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vhk	Vb
LLT /oxxx	Lelant	Ps	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vkh	Vb
LLTd	Lelant	Ps	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vk	Vb
LLTd /oxxx	Lelant	Ps	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vk	Vb
LLTdp	Lelant	Fb*	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vhk	Vb

Table 9. Suitability Ratings of Soils for Selected Engineering Uses (Cont'd)

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Perm. Bldgs. w/Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
LLTp	Leiant	Fb*	Pah	Vw	Vwh	Vwa	Vwa	Vkw	Vw	Vhk	Vh
LLTp /xxxa	Leiant	Vw	Pah	Vw	Vwh	Vwa	Vwa	Vkw	Vw	Vhk	Vh
LLT /xxxa	Leiant	Pns	Pa	Pw	Pw	Pw	Vwa	Vk	Pw	Vhk	Vh
LOP	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /oxxx	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /1xxx	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /2xxx	Long Plain	Vb	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /3xxx	Long Plain	Vb	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /xcxx	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /ocxx	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /1cxx	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /2cxx	Long Plain	Vb	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /xdxx	Long Plain	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fe	Vk	Fhg
LOP /xexx	Long Plain	Pst	Pa	Fw	Pw	Fwt	Vak	Vk	Fe	Vkt	Fhg
LOP /xfxx	Long Plain	Vt	Pa	Fwt	Pwt	Pt	Vak	Vk	Pt	Vkt	Phg
MHC	Marsh Complex	Vw	Va	Vw	Vw	Vw	Vw	Vw	Vw	Vh	Vh
MKY	Mockry	Ps	Pa	Pw	Pw	Pw	Vwa	Vk	Pw	Vk	Vh
MKYp	Mockry	Fb*	Pah	Vw	Vwh	Vaw	Vwa	Vkw	Vw	Vkh	Vh
NBG	Neuenberg	G	Paq	Fw	Pw	Faw	Vak	Pk	G	Vk	Fhg
NBG /xxxa	Neuenberg	Pn	Paq	Fw	Pw	Faw	Vak	Pk	G	Vk	Fhg
NBG /oxxx	Neuenberg	G	Paq	Fw	Pw	Faw	Vak	Pk	G	Vk	Fhg
NUH	Neuhorst	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
NUH /xxxa	Neuhorst	Pn	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
NWN	Newton Siding	Fs	Paq	Fw	Pw	Faw	Vak	Fwg	Fe	Vk	Fhk
OBR	Oberon	Fab	Pq	Fw	Pw	Faw	Vak	Fwg	Fe	Vk	Fkg
ONH	Onahan	Ps	G	Fw	Pw	Fw	Vak	Vk	Va	Vk	Fhg
ONH /xcxx	Onahan	Ps	G	Fw	Pw	Fw	Vak	Vk	Va	Vk	Fhg
ONH /xexx	Onahan	Pst	G	Fw	Pw	Fwt	Vak	Vk	Va	Vkt	Ftg
ONH /xfxx	Onahan	Vt	G	Fw	Pwt	Pt	Vak	Vk	Va	Vkt	Ptg
OBO	Osborne	Ps	Va	Paw	Pw	Paw	Vw	Pw	Paw	G	Vhk
OWK	Osterwick	G	Va	Pw	Pw	Pw	Vw	Pkw	Pw	Pkh	Vh
PER	Perillo	G*	Va	Vaw	Vaw	Vaw	Vaw	Vw	Vaw	Vah	Vh
PTR	Petrel	G	Pq	Fw	Pw	Faw	Vak	Pk	G	Vk	Fhg
PLE	Pleasant	G	Va	Faw	Pw	Faw	Pkw	Pk	G	Pk	Phg
PLE /xcxx	Pleasant	G	Va	Faw	Pw	Faw	Pkw	Pk	G	Pk	Phg
PME	Plum Coulee	Ps	Va	Pa	Paw	Fa	Pwa	Fw	Pa	Fh	Phk
POX	Poolex	G	Va	Pw	Pw	Pw	Vw	Pkw	Pw	Phk	Vh
POXp	Poolex	Fb*	Va	Vw	Vw	Vw	Vw	Vw	Vw	Vh	Vh
PDA	Prodan	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
PDA /xcxx	Prodan	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fkt	Ph
PSE	Prosser	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Fhg
RAM	Ramada	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
RWL	Rathwell	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
RWL /xxxa	Rathwell	Pn	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
RIV	Red River	Ps	Va	Pa	Paw	Pa	Pwa	Fw	Ps	G	Vk
RFD	Reinfeld	G	Va	Fa	Fa	Fa	G	G	G	Fak	Fk
RLD	Reinland	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
RLD /xxxa	Reinland	Pn	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
RLD /oxxx	Reinland	G	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
RLD /1xxx	Reinland	Fb	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
RLD /2xxx	Reinland	Pb	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
RLD /1cxx	Reinland	Fb	Va	Faw	Pw	Faw	Pwk	Pk	G	Pk	Phg
RGD	Rignold	G	Va	Faw	Paw	Faw	Paw	Fw	Fs	Fk	Phd
RBK	Rosebank	Ps	Va	Fw	Paw	Fw	Pwa	Pk	Fs	Fa	Phd
RBK /xxxa	Rosebank	Psn	Va	Fw	Paw	Fw	Pwa	Pk	Fs	Fa	Phd
RBK /oxxx	Rosebank	Ps	Va	Fw	Paw	Fw	Pwa	Pk	Fs	Fa	Phd
SUE	St.Claude	Fb	Paq	Faw	Pw	Pf	Vha	Phk	G	Vk	Phg
SUE /xxxa	St.Claude	Pn	Paq	Faw	Pw	Pf	Vha	Phk	G	Vk	Phg
SUE /xxxt	St.Claude	Va	Paq	Faw	Pw	Pf	Vha	Phk	G	Vk	Phg
SUE /oxxx	St.Claude	Fb	Paq	Faw	Pw	Pf	Vha	Phk	G	Vk	Phg
SUE /1xxx	St.Claude	Fb	Paq	Faw	Pw	Pf	Vha	Phk	G	Vk	Phg
SUE /xcxx	St.Claude	Fb	Paq	Faw	Pw	Pf	Vha	Phk	G	Vk	Phg

Table 9. Suitability Ratings of Soils for Selected Engineering Uses (Cont'd)

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Perm. Bldgs. w/Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
SCY	Scanterbury	Ps	Va	Pa	Paw	Pa	Pws	Fw	Ps	G	Vk
SEE	Sewell	Ps	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vk	Vh
SEEp	Sewell	Fb*	Pah	Vw	Vwh	Vaw	Vws	Vkw	Vw	Vhk	Vh
SEE /xdxx	Sewell	Ps	Pa	Pw	Pw	Pw	Vws	Vk	Pw	Vk	Vh
SEU	Shellmouth Complex	Pb	Va	Fa	Fa	Fa	Pk	Pk	Fs	Pk	Fk
SEU /xexx	Shellmouth Complex	Pbt	Va	Fa	Ft	Fat	Pk	Pk	Fst	Vt	Fkt
SEU /xfxx	Shellmouth Complex	Vbt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
SEU /3fxx	Shellmouth Complex	Vbt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
SEU /xgxx	Shellmouth Complex	Vbt	Va	Pt	Vt	Vt	Pkt	Vt	Vt	Vt	Vt
SHX	Shilox	Vb	G	G	G	G	Vak	Vk	Vs	Vk	Gg
SHX /xcxx	Shilox	Vb	G	G	G	G	Vak	Vk	Vs	Vk	Gg
SHX /xdxx	Shilox	Vb	G	G	G	G	Vak	Vk	Vs	Vk	Gg
SHX /xexx	Shilox	Vb	G	G	Ft	Ft	Vak	Vk	Vs	Vkt	Ftg
SHX /1exx	Shilox	Vb	G	G	Ft	Ft	Vak	Vk	Vs	Vkt	Ftg
SHX /3exx	Shilox	Vb	G	G	Ft	Ft	Vak	Vk	Vs	Vkt	Ftg
SHX /xfxx	Shilox	Vbt	G	Ft	Pt	Pt	Vak	Vk	Vs	Vkt	Ptg
SHX /1fxx	Shilox	Vbt	G	Ft	Pt	Pt	Vak	Vk	Vs	Vkt	Ptg
SHX /3fxx	Shilox	Vbt	G	Ft	Pt	Pt	Vak	Vk	Vs	Vkt	Ptg
SHX /xgxx	Shilox	Vbt	G	Pt	Vt	Vt	Vak	Vkt	Vst	Vkt	Vtg
SKL	Skelding	Vb	G	G	G	G	Vak	Vk	Vs	Vk	Gg
SKL /xcxx	Skelding	Vb	G	G	G	G	Vak	Vk	Vs	Vk	Gg
SKL /xdxx	Skelding	Vb	G	G	G	G	Vak	Vk	Vs	Vk	Gg
SKL /xfxx	Skelding	Vbt	G	Ft	Pt	Pt	Vak	Vk	Vs	Vkt	Ptg
SQR	Squirrel Creek	Fb	Va	Pa	Paw	Pf	Vh	Ph	G	G	Phd
SQR /xxxs	Squirrel Creek	Pn	Va	Pa	Paw	Pf	Vh	Ph	G	G	Phd
SCK	Stockton	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
SCK /xcxx	Stockton	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
SCK /odxx	Stockton	Ps	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
SCK /2dxx	Stockton	Pbs	Pa	G	G	G	Vak	Vk	Fs	Vk	Gg
SCK /3exx	Stockton	Vb	Pa	G	Ft	Ft	Vak	Vk	Fst	Vkt	Ftg
TDP	Tadpole	Vw	Va	Pw	Pw	Pw	Vw	Pw	Pw	Ph	Vh
TDPp	Tadpole	Fb*	Va	Vw	Vw	Vw	Vw	Vhw	Vw	Vh	Vh
TGR	Taggart	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Ph
TOC	Torcan	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Ph
VDS	Vordas	G	Va	Pw	Pw	Pw	Vw	Pw	Pw	Vh	Vh
VDS /xcxx	Vordas	G	Va	Pw	Pw	Pw	Vw	Pw	Pw	Ph	Vh
WWD	Wellwood	Fs	Pq	Fa	G	Fa	Vak	Gg	Fs	Vk	Fkg
WWB	Willowbend	Pi	Va	Pw	Vi	Vi	Vi	Vi	Vw	Vi	Vi
WWB /xxxs	Willowbend	Pin	Va	Pw	Vi	Vi	Vi	Vi	Vw	Vi	Vi
WWC	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /oxxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /1xxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /2xxx	Willowcrest	Pbs	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /3xxx	Willowcrest	Vb	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /xcxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /ocxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /1cxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vk	Fs	Vk	Phg
WWC /xdxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vak	Vx	Fs	Vk	Phg
XVI	Xavier	G	Va	Vaw	Vaw	Vaw	Vsw	Vw	Vsw	Vah	Vh

* Applies to footnote 3 in topsoil rating guide

Table 10. Suitability Ratings of Soils for Recreational Uses

Map Symbol and Phase		Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
ASS		Almasippi	Fsw	Fsw	Fsw	Fw	Fw
ASS	/oxxx	Almasippi	Ps	Fsw	Fsw	Ps	Fw
ASS	/1xxx	Almasippi	Fsw	Fsw	Fsw	Fw	Fw
ASS	/2xxx	Almasippi	Fsw	Fsw	Fsw	Fw	Fw
ASS	/xcxx	Almasippi	Fwt	Fsw	Fsw	Fw	Fw
ASS	/ocxx	Almasippi	Ps	Fsw	Fsw	Ps	Fw
ASS	/1cxx	Almasippi	Fst	Fsw	Fsw	Fw	Fw
ASS	/xdxx	Almasippi	Pt	Fsw	Fsw	Fw	Fw
AIZ		Arizona	Ps	Fs	Fs	Ps	G
AIZ	/xdxx	Arizona	Pts	Fs	Fs	Ps	G
AIZ	/3dxx	Arizona	Vs	Vs	Vs	Vs	G
ARN		Aronet	Vs	Vs	Vs	Vs	G
BKA		Birkenhead	Ps	Pm	Fs	G	G
BKA	/xcxx	Birkenhead	Ps	Pm	Fs	G	G
BKA	/2cxx	Birkenhead	Ps	Pm	Fs	Ps	G
BKA	/2exx	Birkenhead	Vt	Pm	Fst	Ps	Ft
BNF		Blumenfeld	Pw	Pw	Pw	Pw	Pw
BNFp		Blumenfeld	Vsw	Vsw	Vsw	Vsw	Va
BNF	/xxxs	Blumenfeld	Pw	Pwn	Pwn	Pw	Pw
BNE		Bone	Fw	Fw	Fw	Fw	Faw
BNE	/xcxx	Bone	Fwt	Fw	Fw	Fw	Faw
BNE	/1dxx	Bone	Pt	Fw	Fw	Fw	Faw
CXV	/ocxx	Charman	Fwt	Fsw	Fsw	Fsw	Faw
DLN		Danlin	Fsw	Fsw	Fsw	Fsw	Faw
DLN	/ocxx	Danlin	Fst	Fsw	Fsw	Fsw	Faw
DLN	/xdxx	Danlin	Pt	Fsw	Fsw	Fsw	Faw
DHO		Deadhorse	Ps	Ps	Ps	Ps	Pa
DNH		Denham	Fs	Fs	Fs	Fs	Fa
DNH	/xcxx	Denham	Ft	Fs	Fs	Fs	Fa
DOB		Dobbin	Fms	Fms	Fs	G	G
DOB	/xcxx	Dobbin	Fmt	Fms	Fs	G	G
DOB	/ocxx	Dobbin	Ps	Fms	Fs	Ps	G
DOB	/1cxx	Dobbin	Fmt	Fms	Fs	G	G
DOB	/2cxx	Dobbin	Fmt	Fms	Fs	G	G
DOB	/3cxx	Dobbin	Ps	Fms	Fs	Ps	G
DOB	/xdxx	Dobbin	Pt	Fms	Fs	G	G
DOB	/odxx	Dobbin	Pts	Fms	Fs	Ps	G
DOB	/1dxx	Dobbin	Pt	Fms	Fs	G	G
DOB	/2dxx	Dobbin	Pt	Fms	Fs	G	G
DOB	/3dxx	Dobbin	Pts	Fms	Fs	Ps	G
DOB	/xexx	Dobbin	Vt	Fmt	Fst	G	Ft
DOB	/oexx	Dobbin	Vt	Fmt	Fst	Ps	Ft
DOB	/1exx	Dobbin	Vt	Fmt	Fst	G	Ft
DOB	/2exx	Dobbin	Vt	Fmt	Fst	G	Ft
DOB	/3exx	Dobbin	Vt	Fmt	Fst	Ps	Ft
DOB	/xfxx	Dobbin	Vt	Pt	Pt	Ft	Pt
DOB	/1fxx	Dobbin	Vt	Pt	Pt	Ft	Pt
DOB	/2fxx	Dobbin	Vt	Pt	Pt	Ft	Pt
EDK		Edkins	Pw	Pw	Pw	Pw	Pw
EDKp		Edkins	Vws	Vws	Vws	Vws	Va
EGF		Eigenhof	Fs	Fs	Fs	Fs	Fa
EEK		Elm Creek	Fsw	Fsw	Fsw	Fw	Fw
ERX		Eroded Slope Comp	Vt	Vt	Vt	Pt	Vt
FND		Fairland	G	G	G	G	Fa
FND	/xcxx	Fairland	Ft	G	G	G	Fa
FIR		Firdale	Fs	Fs	Fs	Fs	Fa
FIR	/xcxx	Firdale	Fst	Fs	Fs	Fs	Fa
FIR	/ocxx	Firdale	Fst	Fs	Fs	Fs	Fa
FIR	/1cxx	Firdale	Fst	Fs	Fs	Fs	Fa
FIR	/xdxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR	/1dxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR	/2dxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR	/3dxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR	/xexx	Firdale	Vt	Fst	Fst	Fs	Fat
FIR	/1exx	Firdale	Vt	Fst	Fst	Fs	Fat

Table 10. Suitability Ratings of Soils for Recreational Uses (Cont'd)

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
FIR /2exx	Firdale	Vt	Fst	Fst	Fs	Fat
FIR /3exx	Firdale	Vt	Fst	Fst	Fs	Fat
FIR /xfxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /1fxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /2fxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /3fxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /2gxx	Firdale	Vt	Vt	Vt	Pt	Vt
FIR /3gxx	Firdale	Vt	Vt	Vt	Pt	Vt
FTE	Fortier	Ps	Ps	Ps	Ps	Pa
GTD	Gateside	Fw	Fw	Fw	Fw	Faw
GVS	Gervais	Fsw	Fsw	Fsw	Fsw	Pi
GVS /xexx	Gervais	Vt	Fst	Fsw	Fsw	Pi
GBO /xcxx	Glenboro	Ft	G	G	G	G
GDH	Gnadenthal	Fw	Fw	Fw	Fw	Faw
GDH /xxxs	Gnadenthal	Fwn	Pwn	Pwn	Fw	Faw
GDH /2cxx	Gnadenthal	Fwt	Fw	Fw	Fw	Fwa
GYV	Graysville	Fw	Fw	Fw	Fw	Fw
GYV /xxxs	Graysville	Pw	Pwn	Pwn	Fw	Fw
GRO /xcxx	Grover	Fwt	Fw	Fw	Fw	Fw
HAT	Halstead	G	G	G	G	G
HAT /1xxx	Halstead	G	G	G	G	G
HAT /2xxx	Halstead	G	G	G	G	G
HAT /xcxx	Halstead	Ft	G	G	G	G
HAT /ocxx	Halstead	Ft	G	G	G	G
HAT /1cxx	Halstead	Ft	G	G	G	G
HAT /2cxx	Halstead	Ft	G	G	G	G
HAT /3cxx	Halstead	Ft	G	G	G	G
HAT /xdxx	Halstead	Pt	G	G	G	G
HAT /odxx	Halstead	Pt	G	G	G	G
HAT /1dxx	Halstead	Pt	G	G	G	G
HAT /2dxx	Halstead	Pt	G	G	G	G
HAT /3dxx	Halstead	Pt	G	G	G	G
HAT /xexx	Halstead	Vt	Ft	Ft	G	Fat
HAT /oexx	Halstead	Vt	Ft	Ft	G	Fat
HAT /1exx	Halstead	Vt	Ft	Ft	G	Fat
HAT /2exx	Halstead	Vt	Ft	Ft	G	Fat
HAT /3exx	Halstead	Vt	Ft	Ft	G	Fat
HAT /xfxx	Halstead	Vt	Pt	Pt	Ft	Pt
HAT /1fxx	Halstead	Vt	Pt	Pt	Ft	Pt
HAT /2fxx	Halstead	Vt	Pt	Pt	Ft	Pt
HAT /3fxx	Halstead	Vt	Pt	Pt	Ft	Pt
HAT /3gxx	Halstead	Vt	Vt	Vt	Pt	Vt
HIN	Hibsin	Fs	Fs	Fs	G	Fa
HMO	Hummerston	Fsw	Fsw	Fsw	Fw	Fw
HMO /xcxx	Hummerston	Fwt	Fsw	Fsw	Fw	Fw
JST	Jasset	Fw	Fw	Fw	Fw	Fw
KOT	Kronstal	Fw	Fw	Fw	Fw	Faw
KOT /1xxx	Kronstal	Fw	Fw	Fw	Fw	Faw
KOT /xcxx	Kronstal	Fwt	Fw	Fw	Fw	Faw
LSL	La Salle	Fs	Fs	Fs	Fs	Pi
LSL /xcxx	La Salle	Fst	Fs	Fs	Fs	Pi
LVH	Lavenham	Fsw	Fsw	Fsw	Fw	Fw
LVH /xcxx	Lavenham	Fwt	Fsw	Fsw	Fw	Fw
LRY	Leary	Ps	Pm	Fs	G	G
LLT	Lelant	Pw	Pw	Pw	Pw	Pw
LLT /oxxx	Lelant	Pw	Pw	Pw	Pw	Pw
LLTd	Lelant	Pw	Pw	Pw	Pw	Pw
LLTd /oxxx	Lelant	Pw	Pw	Pw	Pw	Pw
LLTdp	Lelant	Vs	Vs	Vs	Vs	Va
LLTp	Lelant	Vsw	Vsw	Vsw	Vsw	Va
LLTp /xxxs	Lelant	Vsw	Vsw	Vsw	Vsw	Va
LLT /xxxs	Lelant	Vw	Vw	Vw	Pw	Pw
LOP	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP /oxxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP /1xxx	Long Plain	Fsw	Fsw	Fsw	Fw	Fw

Table 10. Suitability Ratings of Soils for Recreational Uses (Cont'd)

Map Symbol and Phase		Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
LOP	/2xxx	Long Plain	Fsw	Fsw	Fsw	Fw	Fw
LOP	/3xxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP	/xcxx	Long Plain	Fwt	Fsw	Fsw	Fw	Fw
LOP	/ocxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP	/1cxx	Long Plain	Fst	Fsw	Fsw	Fw	Fw
LOP	/2cxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP	/xdxx	Long Plain	Pt	Fsw	Fsw	Ps	Fw
LOP	/xexx	Long Plain	Vt	Fwt	Fst	Ps	Fwt
LOP	/xfxx	Long Plain	Vt	Pt	Pt	Fwt	Pt
MHC		Marsh Complex	Vw	Vw	Vw	Vw	Vw
MKY		Mockry	Pw	Pw	Pw	Pw	Pw
MKYp		Mockry	Vsw	Vsw	Vsw	Vsw	Va
NBG		Neuenberg	Fw	Fw	Fw	Fw	Faw
NBG	/xxxs	Neuenberg	Fwn	Pwn	Pwn	Fw	Faw
NBG	/oxxx	Neuenberg	Fw	Fw	Fw	Fw	Faw
NUH		Neuhorst	Fsw	Fsw	Fsw	Fsw	Faw
NUH	/xxxs	Neuhorst	Fsn	Pnw	Pnw	Fsw	Faw
NWN		Newton Siding	Fsw	Fsw	Fsw	Fsw	Faw
OBR		Oberon	Fsw	Fs	Fsw	Fsw	Fw
ONH		Onahan	Fw	Fsw	Fsw	Fw	Fw
ONH	/xcxx	Onahan	Fwt	Fsw	Fsw	Fw	Fw
ONH	/xexx	Onahan	Vt	Fwt	Fwt	Fw	Fwt
ONH	/xfxx	Onahan	Vt	Pt	Pt	Fwt	Pwt
OBO		Osborne	Psw	Psw	Psw	Psw	Paw
OWK		Osterwick	Pw	Pw	Pw	Pw	Pw
PER		Perillo	Vsw	Vsw	Vsw	Vsw	Vaw
PTR		Petrel	Fw	Fw	Fw	Fw	Fw
PLE		Pleasant	Fw	Fw	Fw	Fw	Faw
PLE	/xcxx	Pleasant	Fwt	Fw	Fw	Fw	Faw
PME		Plum Coulee	Ps	Ps	Ps	Ps	Pa
POX		Poolex	Pw	Pw	Pw	Pw	Pw
POXp		Poolex	Vw	Vw	Vw	Pw	Va
PDA		Prodan	Fsw	Fsw	Fsw	Fsw	Faw
PDA	/xcxx	Prodan	Fst	Fsw	Fsw	Fsw	Faw
PSE		Prosser	G	G	G	G	Fa
RAM		Ramada	Fs	Fs	Fs	Fs	Fa
RWL		Rathwell	Fsw	Fsw	Fsw	Fsw	Faw
RWL	/xxxs	Rathwell	Fnw	Pnw	Pnw	Fsw	Faw
RIV		Red River	Ps	Ps	Ps	Ps	Pa
RFD		Reinfeld	G	G	G	G	Fa
RLD		Reinland	Fw	Fw	Fw	Fw	Faw
RLD	/xxxs	Reinland	Fwn	Pwn	Pwn	Fw	Faw
RLD	/oxxx	Reinland	Fw	Fw	Fw	Fw	Faw
RLD	/1xxx	Reinland	Fw	Fw	Fw	Fw	Faw
RLD	/2xxx	Reinland	Fw	Fw	Fw	Fw	Faw
RLD	/1cxx	Reinland	Fwt	Fw	Fw	Fw	Fw
RGD		Rignold	Fw	Fw	Fw	Fw	Faw
RBK		Rosebank	Fw	Fw	Fw	Fw	Fw
RBK	/xxxs	Rosebank	Fwn	Pnw	Pnw	Fw	Fw
RBK	/oxxx	Rosebank	Fw	Fw	Fw	Fw	Fw
SUE		St.Claude	Pw	Pw	Pw	Fsw	Pf
SUE	/xxxs	St.Claude	Pw	Pw	Pw	Fsw	Pf
SUE	/xxxt	St.Claude	Pwn	Vn	Vn	Fws	Pf
SUE	/oxxx	St.Claude	Pw	Pw	Pw	Fw	Pf
SUE	/1xxx	St.Claude	Pw	Pw	Pw	Fsw	Pf
SUE	/xcxx	St.Claude	Pw	Pw	Pw	Fsw	Pf
SCY		Scanterbury	Ps	Ps	Ps	Ps	Pa
SEE		Sewell	Pw	Pw	Pw	Pw	Pw
SEEp		Sewell	Vsw	Vsw	Vsw	Vsw	Va
SEE	/xdxx	Sewell	Pwt	Pw	Pw	Pw	Pw
SEU		Shellmouth Complex	G	Fs	Fs	Fs	Fa
SEU	/xexx	Shellmouth Complex	Vt	Fst	Fst	Fs	Fat
SEU	/xfxx	Shellmouth Complex	Vt	Pt	Pt	Fst	Pt
SEU	/3fxx	Shellmouth Complex	Vt	Pt	Pt	Fst	Pt
SEU	/xgxx	Shellmouth Complex	Vt	Vt	Vt	Pt	Vt

Table 10. Suitability Ratings of Soils for Recreational Uses (Cont'd)

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
SHX	Shilox	Vs	Vs	Vs	Vs	G
SHX /xcxx	Shilox	Vs	Vs	Vs	Vs	G
SHX /xdxx	Shilox	Vs	Vs	Vs	Vs	G
SHX /xexx	Shilox	Vst	Vs	Vs	Vs	Ft
SHX /1exx	Shilox	Vst	Vs	Vs	Vs	Ft
SHX /3exx	Shilox	Vst	Vs	Vs	Vs	Ft
SHX /xfxx	Shilox	Vst	Vs	Vs	Vs	Pt
SHX /1fxx	Shilox	Vst	Vs	Vs	Vs	Pt
SHX /3fxx	Shilox	Vst	Vs	Vs	Vs	Pt
SHX /xgxx	Shilox	Vst	Vst	Vst	Vs	Vt
SKL	Skelding	Vs	Vs	Vs	Vs	G
SKL /xcxx	Skelding	Vs	Vs	Vs	Vs	G
SKL /xdxx	Skelding	Vs	Vs	Vs	Vs	G
SKL /xfxx	Skelding	Vst	Vs	Vs	Vs	Pt
SQR	Squirrel Creek	Pw	Pw	Pw	Fsw	Pf
SQR /xxxs	Squirrel Creek	Pw	Pwn	Pwn	Faw	Pf
SCK	Stockton	Fs	Fs	Fs	G	G
SCK /xcxx	Stockton	Fst	Fs	Fs	G	G
SCK /odxx	Stockton	Pts	Fms	Fs	Ps	G
SCK /2dxx	Stockton	Pt	Fms	Fs	G	G
SCK /3exx	Stockton	Vt	Fmt	Fst	Ps	Ft
TDP	Tadpole	Vw	Vw	Vw	Pw	Pw
TDPp	Tadpole	Vw	Vw	Vw	Pw	Va
TGR	Taggart	Fsw	Fsw	Fsw	Fsw	Faw
TOC	Torcan	Fsw	Fsw	Fsw	Fsw	Faw
VDS	Vordas	Pw	Pw	Pw	Pw	Pw
VDS /xcxx	Vordas	Pw	Pw	Pw	Pw	Pw
WWD	Wellwood	Fs	Fs	Fs	Fs	Fa
WWB	Willowbend	Viw	Viw	Viw	Viw	Vi
WWB /xxxs	Willowbend	Viw	Viw	Viw	Viw	Vi
WWC	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC /oxxx	Willowcrest	Ps	Fsw	Fsw	Ps	Fw
WWC /1xxx	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC /2xxx	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC /3xxx	Willowcrest	Ps	Fsw	Fsw	Ps	Fw
WWC /xcxx	Willowcrest	Fwt	Fsw	Fsw	Fw	Fw
WWC /ocxx	Willowcrest	Ps	Fsw	Fsw	Ps	Fw
WWC /1cxx	Willowcrest	Fst	Fsw	Fsw	Fw	Fw
WWC /xdxx	Willowcrest	Pt	Fsw	Fsw	Fw	Fw
XVI	Xavier	Vsw	Vsw	Vsw	Vsw	Vaw

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APPENDIX A

GLOSSARY

AASHO classification (soil engineering) - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

Acid soil - A soil having a pH less than 7. See pH and Reaction, soil.

Alkaline soil - A soil having a pH greater than 7. See Reaction, soil.

Alluvium - A general term for all deposits of rivers and streams.

Arable soil - Soil suitable for plowing and cultivation.

Association - A sequence of soils of about the same age, derived from similar parent material, and occurring under similar climatic conditions but showing different characteristics due to variations in relief and in drainage.

1/3 Atmosphere Moisture - The moisture percentage on dry weight basis of a soil sample that has been air dried, screened, saturated and subjected to a soil moisture tension of 345 cm of water through a permeable membrane for a period of 48 hours. It approximates the soil moisture retention capacity.

Available nutrient - That portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

Available soil moisture - The portion of water in a soil that can be readily absorbed by plant roots: generally considered to be that water held in the soil up to approximately 15 atmospheres pressure.

Bearing capacity - Capacity of soil (in moist to wet conditions) to support loads such as buildings, people, vehicles, and animals.

Bedrock - The solid rock that underlies soil and regolith or that is exposed at the surface.

Boulders - Stones which are larger than 60 cm in diameter.

Bulk density - The weight of oven dry soil (105 degrees C) divided by its volume at field moisture conditions, expressed in grams per cubic centimeter.

Buried soil - Soil covered by an alluvial, loessial, or other deposit, usually to a depth greater than the thickness of the solum.

Calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with hydrochloric acid.

Calcium Carbonate Equivalent - Refers to the percent of carbonates in the soil expressed on the basis of calcium carbonate. Terms used to express the carbonate contents of soils are:

noncalcareous. . . . . . . <1%
weakly calcareous. . . . 1-5%
moderately calcareous. .6-15%
strongly calcareous. . 16-25%
v. strongly calcareous.26-40%
extremely calcareous. . . >40%

Capillary fringe - A zone of essentially saturated soil just above the water table. The size distribution of the pores determines the extent and degree of the capillary fringe.

Carbon-nitrogen ratio (C/N ratio) -The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

Cation Exchange Capacity (CEC) - A measure of the total amount of exchangeable cations that can be held by a soil. Expressed in milliequivalents per 100g of soil.

Clay - As a soil separate, the mineral soil particles less than 0.002 mm in diameter: usually consisting largely of clay minerals. As a soil textural class, soil materials that contain 40 or more percent clay, less than 45 percent sand and less than 40 percent silt.

Cobbles - Rock fragments 8 to 25 cm in diameter.

Color - Soil colors are compared with a Munsell color chart. The Munsell system specifies the relative degrees of the three simple variables of color: hue, value and chroma. For example: 10YR 6/4 means a hue of 10YR, a value of 6, and a chroma of 4.

Complex (soil) - A mapping unit used in detailed and reconnaissance soil surveys where two or more soil series that are so intimately intermixed in an area that it is impractical to separate them at the scale of mapping used.

Concretions - Hard grains, pellets or nodules from concentration of compounds in the soil that cement soil grains together.

Conductivity, electrical - A physical quantity that measures the readiness with which a medium (irrigation water and soil extracts) transmits electricity. It ex-presses the concentration of salt in terms of the conductance (reciprocal of the electric resistance in ohms) in milliSiemens per cm (or expressed as deciSiemens per meter - dS/m).

Consistence (soil) - The mutual attraction of the particles in a soil mass, or their resistance to separation or deformation. It is described in terms such as loose, soft, friable, firm, hard, sticky, plastic or cemented.

Consumptive use factor (CU) - The ratio of consumptive use of water by a crop to potential evapotranspiration and transpiration. An actively growing crop that completely covers the soil over a large area and that has an ample supply of readily available soil water has a consumptive use factor of 1.0.

Consumptive use of water - The sum of the depths of water transpired by the plants and evaporated from the soil surface and from intercepted precipitation. It may be less or greater than potential evapotranspiration.

Contour - An imaginary line connecting points of equal elevation on the surface of the soil.

Cover - This term generally has one of the following meanings:

1. Vegetation or other material providing protection
2. In forestry, low growing shrubs and herbaceous plants under trees (i.e., ground cover vs. tree cover)
3. Any vegetation producing a protective mat on or just above the soil surface.

Creep (soil) - Slow mass movement of soil and soil material down rather steep slopes primarily under the influence of gravity, but aided by saturation with water and by alternate freezing and thawing.

Decile portion - A one-tenth portion. As used in the soil map symbol A7-B3 means that the A soils cover seven tenths and the B soils cover three tenths of the map unit.

Delta - A fluvial or glaciofluvial fan shaped deposit at the mouth of a river that empties into a lake or sea.

Deflocculate - To separate or to break up soil aggregates into individual particles by chemical or physical means or both.

Degradation (of soils) - The changing of a soil to a more highly leached and more highly weathered condition, usually accompanied by morphological changes such as the development of an eluviated light colored (Ae) horizon.

Dispersion - Is rated high, moderate or low depending on how readily the soil structure breaks down or slakes because of excess moisture. A rating of high indicates that soil aggregates slake readily;a rating of low indicates that aggregates are resistant to dispersion and remain clumped together.

Drainage (soil) - (1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (2) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

Drainage in soil reports is described on the basis of actual moisture content in excess of field capacity and length of the saturation period within the plant root zone. The terms are as follows:

Very rapidly drained - Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall provided there is a steep gradient. Soils have very low available water storage capacity (usually less than 2.5 cm) within the control section and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Rapidly drained - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm) within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Well drained - Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm) within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations but additions are equalled by losses. These soils are usually free of mottles within 100 cm of the surface but may be mottled below this depth. Soil horizons are usually bright colored.

Moderately well drained - Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6cm) within the control section and are usually medium to fine in texture. Soils are commonly mottled in the 50 to 100 cm depth. Colors are dull brown in the subsoil with stains and mottles.

Imperfectly drained - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is major supply. If subsurface water or groundwater, or both, is the main source, flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface flow or groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well drained subgroups. These soils generally have mottling below the surface layers and generally have duller colors with depth, generally brownish gray with mottles of yellow and gray.

Poorly drained - Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Poorly drained soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, and Organic soils.

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important except where there is a perched water table with precipitation exceeding evapotranspiration. These soils have a wide range in available water storage capacity, texture, and depth, and are either Gleysolic or Organic.

Dryland farming - The practice of crop production in low rainfall areas without irrigation.

Eluvial horizon - A horizon from which material has been removed in solution or in water suspension.

Eolian - Soil material accumulated through wind action.

Erosion - The wearing away of the land surface by detachment and transport of soil and rock material through the action of moving water, wind or other geological processes. The ratings of erosion are:

Erosion 1	slightly eroded - soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B horizon or other lower lying horizons with surface soil in the plow layer.
Erosion 2	moderately eroded - soil with all of the A horizon and a part of the B or other lower lying horizons removed.

The plow layer consists mainly of the original horizons below the A or below the original plow layer.

Erosion 3 severely eroded - soils have practically all of the original surface soil removed. The plow layer consists mainly of C horizon matericl, especially on knolls and steep upper slope positions.

Evapotranspiration - The combined loss of water from a given area, and during a specific period of time, by evaporation from the soil surface and transpiration from plants.

Field Moisture Equivalent - The minimum moisture content at which a drop of water placed on a smoothed surface of the soil will not be absorbed immediately by the soil, but will spread out over the surface and give it a shiny appearance.

Flood plain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fluvial deposits - All sediments past and present, deposited by flowing water, including glaciofluvial deposits.

Frost heave - The raising of the surface caused by ice in the subsoil.

Friable - Soil aggregates that are soft and easily crushed between thumb and forefinger.

Glaciofluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. These deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers and kame terraces.

Gleyed soil - An imperfectly or poorly drained soil in which the material has been modified by reduction or alternating reduction and oxidation. These soils have lower chromas or more prominent mottling or both in some horizons than the associated well-drained soil.

Gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas or prominent mottling or both, in some horizons.

Gravel - Rock fragments 2 mm to 7.5 cm in diameter.

Ground Moraine - An unsorted mixture of rocks, boulders, sand, silt and clay deposited by glacial ice. The predominant material is till; most till is thought to have accumulated under the ice by lodgment, but some till has been let down from the upper surface of the ice by ablation. Resorting and modification may have taken place to some extent by wave-action of glacial melt waters. The topography is most commonly in the form of undulating plains with gently sloping hills and enclosed depressions.

Groundwater - Water beneath the soil surface, usually under conditions where the voids are completely filled with water (saturation).

Halophytic vegetation - Vegetation that grows naturally in soils having a high content of various salts. It usually has fleshy leaves or thorns and resembles desert vegetation.

Horizon (soil) - A layer in the soil profile approximately parallel to the land surface with more or less well defined characteristics that have been produced through the operation of soil forming processes.

Horizon boundary - The lower boundary of each horizon is described by indicating its distinctness and form. The distinctness depends on the abruptness of vertical change (thickness). The form refers to the variation of the boundary plane.

Distinctness -
abrupt - less than 2 cm
clear - 2 to 5 cm
gradual - 5 to 15 cm
diffuse - more than 15 cm

Form -
smooth - nearly plain
wavy - pockets are wider than deep
irregular - pockets are deeper than wide
broken - parts of the horizon are unconnected with other parts

Humic layer - A layer of highly decomposed organic soil material containing little fibre.

Hydraulic Conductivity - Refers to the effective flow velocity or discharge velocity in soil at unit hydraulic gradient. It is an approximation of the permeability of the soil and is expressed in cm per hour. The classes are described in general or specific terms as:

High >15	Very rapid	>50
	Rapid	15-50
Medium 0.5-15	Mod. rapid	5.0-15
	Moderate	1.5-5.0
	Mod. slow	0.5-1.5
Low <0.5	Slow	0.15-0.5
	Very slow	.015-0.15
	Extremely slow	<.015

Hydrologic cycle - The conditions through which water naturally passes from the time of precipitation until it is returned to the atmosphere by evaporation and is again ready to be precipitated.

Hydrophyte - Plants growing in water or dependent upon wet or saturated soil conditions for growth.

Illuvial horizon - A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. The layer of accumulation.

Impeded drainage - A condition that hinders the movement of water by gravity through the soils.

Inclusion - Soil type found within a mapping unit that is not extensive enough to be mapped separately or as part of a complex.

Infiltration - The downward entry of water into the soil

Irrigation - The artificial application of water to the soil for the benefit of growing crops.

Irrigation requirement (IR) - Refers to the amount of water exclusive of effective precipitation that is required for crop production.

Lacustrine deposits - Material deposited by or settled out of lake waters and exposed by lowering of the water levels or elevation of the land. These sediments range in texture from sand to clay and are usually varved (layered annual deposits).

Landforms - See Description of Landforms

Landscape - All the natural features such as fields, hills, forest, water, etc., which distinguish one part of the earth's surface from another part.

Leaching - The removal from the soil of materials in solution.

Liquid limit (upper plastic limit) -The water content corresponding to an arbitrary limit between the liquid and plastic states of consistency of a soil. The water content at this boundary is defined as that at which a pat of soil cut by a groove of standard dimensions will flow together for a distance of 1.25 cm under the impact of 25 blows in a standard liquid limit apparatus.

Lineal shrinkage - This is the decrease in one dimension expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from a stipulated percentage (usually field moisture equivalent) to the shrinkage limit.

Mapping Unit - Any delineated area shown on a soil map that is identified by a symbol. A mapping unit may be a soil unit, a miscellaneous land type, or a soil complex.

Marsh - Periodically flooded or continually wet areas having the surface not deeply submerged. It is covered dominantly with sedges, cattails, rushes or other hydrophytic plants.

Mature soil - A soil having well-developed soil horizons produced by the natural processes of soil formation.

Mesophyte - Plants requiring intermediate moisture conditions and are not very resistant to drought.

Microrelief - Small-scale, local differences in relief including mounds, swales or hollows.

Milliequivalent (me) - One-thousandth of an equivalent. An equivalent is the weight in grams of an ion or compound that combines with or replaces one gram of hydrogen. The atomic or formula weight divided by valence.

Mottles - Irregularly marked spots or streaks, usually yellow or orange but sometimes blue. They are described in order of abundance (few, common, many), size (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottles in soils indicate poor aeration and lack of good drainage.

Organic carbon - Carbon derived from plant and animal residues.

Organic matter - The fraction of the soil which consists of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms and substances synthesized by the soil population. It is determined on soils that have been sieved through a 2.0 mm sieve. It is estimated by multiplying the organic carbon by a factor of 1.72.

Outwash - Sediments "washed out" beyond the glacier by flowing water and laid down in thin beds or strata. Particle size may range from boulders to silt.

Ovendry soil - Soil that has been dried at 105 degrees C until it has reached constant weight.

Parent material - The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

Particle size, soil - The grain size distribution of the whole soil including the coarse fraction. It differs from texture, which refers to the fine earth (less than 2mm) fraction only. In addition, textural classes are usually assigned to specific horizons whereas soil family particle-size classes indicate a composite particle size of a part of the control section that may include several horizons. See Textural Triangle at end of Glossary.

The particle-size classes for family groupings are as follows:

Fragmental - Stones, cobbles and gravel, with too little fine earth to fill interstices larger than 1 mm.

Sandy-skeletal - Particles coarser than 2 mm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the sandy particle size class.

Loamy-skeletal - Particles 2 mm-25 cm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the loamy particle- size class.

Clayey-skeletal - Particles 2 mm-25 cm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the clayey particle size class.

Sandy - The texture of the fine earth includes sands and loamy sands, exclusive of loamy very fine sand and very fine sand textures; particles 2 mm- 25 cm occupy less than 35% by volume.

Loamy - The texture of the fine earth includes loamy very fine sand, very fine sand, and finer textures with less than 35% clay; particles 2 mm-25 cm occupy less than 35% by volume.

Coarse-loamy A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-loamy - A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

Coarse-silty - A loamy particle size that has less than 15% of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-silty - A loamy particle size that has less than 15% of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

Clayey - The fine earth contains 35% or more clay by weight and particles 2mm-25 cm occupy less than 35% by volume.

Fine-clayey - A clayey particle size that has 35-60% clay in the fine earth fraction.

Very-fine-clayey - A clayey particle size that has 60% or more clay in the fine earth fraction.

Ped - An individual soil aggregate such as granule, prism or block formed by natural processes (in contrast with a clod which is formed artificially).

Pedology - Those aspects of soil science involving constitution, distribution, genesis and classification of soils.

Percolation - The downward movement of water through soil; specifically, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of 1.0 or less.

Permafrost -

1. Perennially frozen material underlying the solum.
2. A perennially frozen soil horizon.

Permafrost table - The upper boundary of permafrost, usually coincident with the lower limit of seasonal thaw (active layer).

Permeability - The ease with which water and air pass through the soil to all parts of the profile. See hydraulic conductivity.

pH - The intensity of acidity and alkalinity, expressed as the negative logarithm of the hydrogen ion concentration. A pH of 7 is neutral, lower values indicate acidity and higher values alkalinity (see Reaction, soil).

Phase, soil - A soil phase is used to characterize soil and landscape properties that are not used as criteria in soil taxonomy. The major phase differentiae are: slope, erosion, deposition, stoniness, texture, salinity, and calcareousness.

Plastic Limit - The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil.

Plasticity Index - The numerical difference between the liquid and the plastic limit. The plasticity index gives the range of moisture contents within which a soil exhibits plastic properties.

Potential evapotranspiration (PE) - The maximum quantity of water capable of being lost as water vapor, in a given climate, by a continuous stretch of vegetation covering the whole ground and well supplied with water.

Profile, soil - A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil - The acidity or alkalinity of a soil. Soil reaction classes are characterized as follows:

extremely acid	pH<4.5
very strongly acid	4.5 to 5.0
strongly acid	5.1 to 5.5
medium acid	5.6 to 6.0
slightly acid	6.1 to 6.5
neutral	6.6 to 7.3
mildly alkaline	7.4 to 7.8
mod. alkaline	7.9 to 8.4
strongly alkaline	8.5 to 9.0
very strongly alkaline	>9.0

Regolith - The unconsolidated mantle of weathered rock and soil material on the earth's surface.

Relief - The elevation of inequalities of the land surface when considered collectively.

Runoff - The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

Saline Soil - A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 millisiemens/cm (ms/cm), the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5. Approximate limits of salinity classes are:

non-saline	0 to 4 mS/cm
weakly saline	4 to 8 mS/cm
mod. saline	8 to 15 mS/cm
strongly saline	>15 mS/cm

Salinization - The process of accumulation of salts in the soil.

Salt-Affected Soil - Soil that has been adversely modified for the growth of most crop plants by the presence of certain types of exchangeable ions or of soluble salts. It includes soils having an excess of salts, or an excess of exchangeable sodium or both.

Sand - A soil particle between 0.05 and 2.0 mm in diameter. The textural class name for any soil containing 85 percent or more of sand and not more than 10 percent of clay.

Saturation Percentage - The moisture percentage of a saturated soil paste, expressed on an oven dry weight basis.

Seepage -

1. The escape of water downward through the soil.

2. The emergence of water from the soil along an extensive line of surface in contrast to a spring where water emerges from a local spot.

Series, soil - A category in the Canadian System of

Soil Classification. It consists of soils that have soil horizons similar in their differentiating characteristics and arrangement in the profile, except for surface texture and are formed from a particular type of parent material.

Shrinkage limit - This is the moisture content at which an equilibrium condition of volume change is reached and further reduction in moisture content will not cause a decrease in the volume of the soil mass.

Shrinkage ratio - This is the ratio between the volume change and a corresponding change in moisture content. It equals the apparent specific gravity of the dried soil.

Silt - (a) Individual mineral particles of soil that range in diameter between 0.05 to .002 mm. (b) Soil of the textural class silt contains greater than 80 percent silt and less than 12 percent clay.

Slickenside - Smoothed surfaces along planes of weakness resulting from the movement of one mass of soil against another in soils dominated by swelling clays.

Sodium-Adsorption Ratio (S.A.R.) - A ratio for soil extracts and irrigation waters used to express the relative activity of sodium ions in exchange reactions with other cations in the soil SAR = $Na/((Ca+Mg)/2)^{1/2}$ where the cation concentrations are expressed as milliequivalents per litre.

Soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Soil has been subjected to and influenced by genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and microorganisms, and topography, all acting over a period of time.

Solum - The upper horizons of a soil above the parent material and in which the processes of soil formation are active. It usually comprises the A and B horizons.

Stones - Rock fragments greater than 25 cm in diameter.

Stoniness - The percentage of land surface occupied by stones. The classes of stoniness are defined as follows:

Stones 0. Nonstony – Land having less than 0.01% of surface occupied by stones.

Stones 1. Slightly stony – Land having 0.01–0.1% of surface occupied by stones. Stones 15-30 cm in diameter, 10-30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. Moderately stony – Land having 0.1-3% of surface occupied by stones. Stones 15-30 cm in diameter, 2-10 m apart. Stones cause some interference with cultivation.

Stones 3. Very stony – Land having 3-15% of surface occupied by stones. Stones 15-30 cm in diameter, 1-2 m apart. There are sufficient stones to constitute a serious handicap to cultivation.

Stones 4. Exceedingly stony – Land having 15-50% of surface occupied by stones. Stones 15-30 cm in diameter, 0.7-1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. Excessively stony – Land having more than 50% of surface occupied by stones. Stones 15-30 cm in diameter, less than 0.7 m apart. The land is too stony to permit cultivation.

Storage Capacity - Refers to the maximum amount of readily available water that can be stored within the rooting zone of a crop in a given soil. For practical irrigation purposes, 50 percent of the total soil water between field capacity and wilting point may be considered as readily available.

Stratified materials - Unconsolidated sand, silt and clay arranged in strata or layers. In stratified materials, a bed is a unit layer distinctly separable from other layers and is one or more cm thick but a lamina is a similar layer less than 1 cm thick.

Structure - The combination or arrangement of primary soil particles into aggregates of secondary soil particles, units or peds, which are separated from each other by surfaces of weakness. Structure is expressed in terms of grade, size class and shape type. Grade refers to the distinctness of aggregate development, and is described as structureless, weak, moderate or strong. Structureless refers to the absence of observable aggregation of definite orderly arrangement; the term amorphous is used if soil is massive or coherent, single-grained if noncoherent. The weak to strong aggregates vary in size and are described by class as fine, medium, coarse, and very coarse depending on the shape types. The shape types refers to the dominant configuration of the aggregates and the way they are accommodated. The general shape types are plate-like, block-like and prism-like. The terms are:

Platy - Having thin, plate-like aggregates with faces mostly horizontal.

Prismatic - Having prism-like aggregates with tops and edges, appear plane, level and somewhat angular.

Columnar - Having prism-like aggregates with vertical edges near the top of columns, not sharp.

Granular - Having block-like aggregates that appear as spheroids or polyhedrons having plane or curved surfaces which have slight or no accommodation to the faces of the surrounding peds.

Blocky - Having block-like aggregates with sharp, angular corners.

Subangular blocky - Having block-like aggregates with rounded and flattened faces and rounded corners.

By convention an aggregate is described in the order of grade,class and type, e.g. strong, medium, blocky. In the parent material of soils the material with structural shapes may be designated as pseudo-blocky, pseudo-platy, etc.

Soil Survey - The systematic examination, description, classification, and mapping of soil in an area.

Sulfate Hazard - Refers to the relative degree of attack on concrete by soil and water containing various amounts of sulfate ions. It is estimated from electrolyte measurements and salt analysis on selected profiles and soil sam-ples, and by visual examination of free gypsum within the profile during the course of soil investigation.

Swamp - See Description of Landforms

Texture, soil - The relative proportions of the fine earth (less than 2 mm.) fraction of a soil. Textural classes are usually assigned to specific horizons whereas family particle size classes indicate a composite particle size of a portion of the control section that may include several horizons. See Texture Triangle at end of Glossary.

The size range of the constituent primary particles are as follows:

	Diameter (mm)
Very coarse sand	2.0-1.0
Coarse sand	1.0-0.5
Medium sand	0.5-0.25
Fine sand	0.25-0.10
Very fine sand	0.10-0.05
Silt	0.05-0.002
Clay	< 0.002
Fine clay	< 0.0002

Till, glacial - Unstratified glacial deposits consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Tilth - The physical condition of soil as related to its ease of tillage, fitness as a seedbed, and its impedance to seedling emergency and root penetration.

Topography - Refers to the percent slope and the pattern or frequency of slopes in different directions. A set of 10 slope classes are used to denote the dominant but not necessarily most abundant slopes within a mapping unit.

Slope Class	Slope Name	Percent slope	Approx. degrees
1	level	0-0.5	0
2	nearly level	.5-2.5	.3-1.5
3	very gentle	2-5	1-3
4	gentle	6-9	3.5-5
5	moderate	10-15	6-8.5
6	strong	16-30	9-17
7	very strong	31-45	17-24
8	extreme	46-70	25-35
9	steep	71-100	35-45
10	very steep	>100	>45

Underground runoff - (or seepage) Water flowing towards stream channels after infiltration into the ground.

Unified Soil Classification System (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Urban Land - Areas so altered or obstructed by urban works or structures that identification of soils is not feasible.

Variant, soil - A soil whose properties are believed to be sufficiently different from other known soils to justify a new series name, but comprising such a limited geographic area that creation of a new series is not justified.

Varve - A distinct band representing the annual deposit in sedimentary materials regardless of origin and usually consisting of two layers, one thick light colored layer of silt and fine sand laid down in the spring and summer, and the other a thin, dark colored layer of clay laid down in the fall and winter.

Water balance, soil - Is the daily amount of readily available water retained by the soil. The daily soil-water balance is decreased by the amount that the daily consumptive use exceeds the daily rainfall. When daily rainfall exceeds the consumptive use, the daily balance increases by the amount of the difference unless the soil-water balance is at storage capacity, in which case the excess is assumed to be lost by runoff or deep percolation.

Water table - (groundwater surface; free water surface; groundwater elevation) Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

Water table depths - (cm)

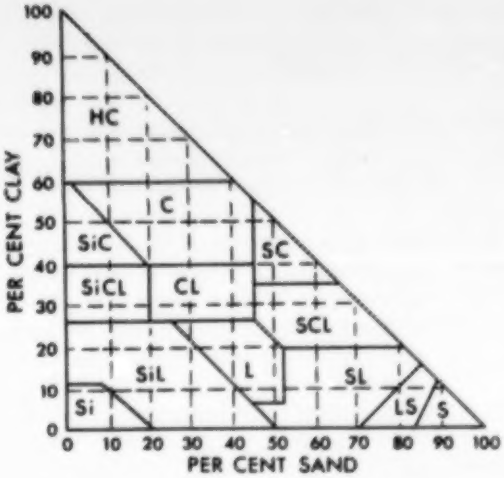
Generally High	<100
Very High	0-50
Moderately High	250-100
Medium High	100-150
Generally Low	>150
Medium Low	150-200
Low	>200
Moderately Low	200-300
Very Low	>300

Water-holding capacity - The ability of a soil to hold water against the force of gravity in a freely drained soil.

Weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

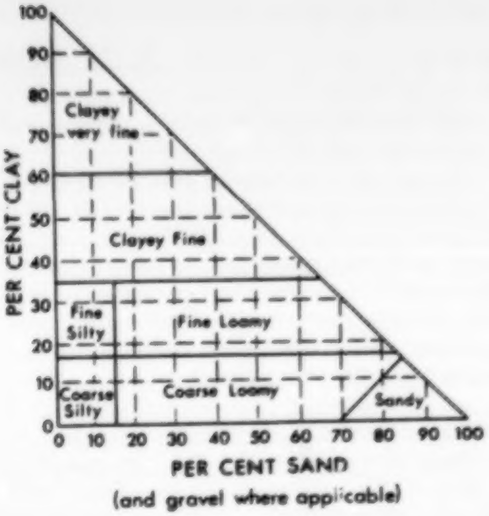
Xerophyte - Plants capable of surviving extended periods of soil drought.

Figure 11. Family particle-size classes



PER CENT CLAY
100
90
80
70
60
50
40
30
20
10
0
HC
C
SiC
SC
SiCL
CL
SCL
SiL
L
SL
Si
LS
S
0 10 20 30 40 50 60 70 80 90 100
PER CENT SAND

Figure 12. Soil Textural Classes



PER CENT CLAY
100
90
80
70
60
50
40
30
20
10
0
Clayey very fine
Clayey Fine
Fine Silty
Fine Loamy
Coarse Silty
Coarse Loamy
Sandy
0 10 20 30 40 50 60 70 80 90 100
PER CENT SAND
(and gravel where applicable)

Texture Group	Class Symbol	Class Name
Coarse	S	sand
	LS	loamy sand
Moderately coarse	SL	sandy loam
	LVFS	loamy very fine sand
Medium	Si	silt
	SiL	silt loam
	L	loam
	VFSL	very fine sandy loam
Moderately fine	SCL	sandy clay loam
	CL	clay loam
	SiCL	silty clay loam
Fine	SC	sandy clay
	C	clay
	SiC	silty clay
Very fine	HC	heavy clay

APPENDIX B

SOIL HORIZON DESIGNATIONS

ORGANIC HORIZONS

Organic horizons are found in Organic soils, and commonly at the surface of mineral soils. They may occur at any depth beneath the surface in buried soils, or overlying geologic deposits. They contain more than 17% organic carbon (approximately 30% organic matter) by weight. Two groups of these horizons are recognized, O horizons and the L, F, and H horizons.

O This is an organic horizon developed mainly from mosses, rushes, and woody materials.

Of The fibric horizon is the least decomposed of all the organic soil materials. It has large amounts of well- preserved fiber that are readily identifiable as to botanical origin. A fibric horizon has 40% or more of rubbed fiber by volume and a pyrophosphate index of 5 or more. If the rubbed fiber volume is 75% or more, the pyrophosphate criterion does not apply.

Om The mesic horizon is the intermediate stage of decompostion with intermediate amounts of fiber, bulk density and water-holding capacity. The material is partly altered both physically and biochemically. A mesic horizon is one that fails to meet the requirements of fibric or humic.

Oh The humic horizon is the most highly decomposed of the organic soil mate- ials. It has the least amount of fiber, the highest bulk density, and the lowest saturated water-holding capacity. It is very stable and changes very little physically or ch- emically with time unless it is drained. The humic horizon has less than 10% rubbed fiber by volume and a pyrophosphate index of 3 or less.

LFH These organic horizons developed primarily from leaves, twigs, woody materials and a minor component of mosses under imperfectly to well drained forest conditions.

L This is an organic horizon characterized by an accumulation of organic matter in which the original structures are easily discernible.

F This is an organic horizon characterized by an accumulation of partly decomposed organic matter. The original structures in part are difficult to recognize. The horizon may be partly comminuted by soil fauna as in moder, or it may be a partly decomposed mat permeated by fungal hyphae as in mor.

H This is an organic horizon characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This material differs from the F horizon by its greater humification chiefly through the action of organisms. It is frequently intermixed with mineral grains, especially near the junction with the mineral horizon.

MASTER MINERAL HORIZONS

Mineral horizons are those that contain less than 30% organic matter by weight as specified for organic horizon.

A This is a mineral horizon or horizons formed at or near the surface in the zone of leaching or removal of materials in solution and suspension or of maximum in situ accumulation of organic matter, or both. Included are:

1. horizons in which organic matter has accumulated as a result of biological activity (Ah);
2. horizons that have been eluviated of clay, iron, alumin-ium, or organic matter, or all of them (Ae);
3. horizons having characteristics of 1) and 2) above but transitional to underlying B or C (AB or A and B);
4. horizons markedly disturbed by cultivation or pasture (Ap).

B This is a mineral horizon or horizons characterized by one or more of the following:

1. an enrichment in silicate clay, iron, aluminum, or humus, alone or in combination (Bt,Bf,Bfh,Bhf, and Bh);
2. a prismatic or columnar structure that exhibits pronounced coatings or stain-ings and significant amount of exchangeable Na (Bn);
3. an alteration by hydrolysis, reduction, or oxidation to give a change in color or structure from horizons above or below, or both, and does not meet the requirements of 1) and 2) above (Bm,Bg).

C This is a mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (i) the process of gleying, and (ii) the accumulation of calcium and magnesium carbonates and more soluble salts (Cca,Csa,Cg, and C). Marl and diatomaceous earth are considered to be C horizons.

R This is consolidated bedrock that is too hard to break with the hands or to dig with a spade when moist and that does not meet he requirement of a C horizon. The boundary between the R layer and overlying unconsolidated material is called a lithic contact.

W This is a layer of water in Gleysolic, Organic, or Cryosolic soils. It is called a hydric layer in Organic soils.

LOWER-CASE SUFFIXES

b Buried soil horizon.

c A cemented (irreversible) pedo-genic horizon. The ortstein of a Podzol, and a layer cemented by calcium carbonate and a duripan are examples.

ca A horizon with secondary carbonate enrichment where the concentration of lime exceeds that present in the unenriched parent material. It is more than 10 cm thick, and if it has a $CaCO_3$ equivalent of less than 15 percent it should have at least 5 percent more $CaCO_3$ equivalent than the parent material (IC). If it has more than 15 percent $CaCO_3$ equivalent it should have 1/3 more $CaCO_3$ equivalent than the IC. If no IC is present, this horizon is more than 10 cm thick and contains more than 5 percent by volume of secondary carbonates in concretions or soft, powdery forms.

cc Cemented (irreversible) pedogenic concretions.

e A horizon characterized by the eluviation of clay, iron, aluminum, or organic matter alone or in combination. When dry, it is usually higher in color value by 1 or more units than an underlying B horizon. It is used with A (Ae).

f A horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It usually has a hue of 7.5YR or redder or its hue is 10YR near the upper boundary and becomes yellower with depth. When moist, the chroma is higher than 3 or the value is 3 or less. It contains 0.6% or more pyrophosphate-extractable Al+Fe in textures finer than sand and 0.4% or more in sands (coarse sand, sand, fine sand, and very fine sand). The ratio of pyrophosphate-extractable Al+Fe to clay (less than 0.002mm) is more than 0.05 and organic C exceeds 0.5%. Pyrophosphate-extractable Fe is at least 0.3%, or the ratio of organic C to pyrophosphate-extractable Fe is less than 20, or both are true. It is used with B alone (Bf), with B and h (Bhf), with B and g (Bfg), and with other suffixes. The criteria for "f" do not apply to Bgf horizons. The following horizons are differentiated on the basis of organic carbon content: Bf - 0.5% to 5% organic carbon. Bhf-more than 5% organic carbon.

g A horizon characterized by gray colors, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less. It is used with A and e (Aeg); with B alone (Bg); with B and f (Bfg); with B, h, and f (Bhfg); with B and t (Btg); with C alone (Cg); with C and k (Ckg); and several others. In some reddish parent materials, matrix colors of reddish hues and high chromas may persist despite long periods of reduction. In these soils, horizons are designated as g if there is gray mottling or if there is marked bleaching on ped faces or along cracks.

Aeg This horizon must meet the definitions of A,e, and g.

Bg These horizons are analogous to Bm horizons but they have colors indicative of poor drainage and periodic reduction. They include horizons occurring between A and C horizons in which the main features are (i) colors of low chroma, that is: chromas of 1 or less, without mottles on ped surfaces or in the matrix if peds are lacking; or chromas of 2 or less in hues of 10YR or redder, on ped surfaces or in the matrix if peds are lacking, accompanied by more prominent mottles than those in the C horizon; or hues bluer than 10Y, with or without mottles on ped surfaces or in the matrix if peds are lacking. (ii) colors indicated in (i) and a change in structure from that of the C horizons. (iii) color indicated in (i) and illuviation of clay too slight to meet the requirements of Bt; or accumulation or iron oxide too slight to meet the limits of Bgf. (iv) colors indicated in (i) and removal of carbonates. Bg horizons occur in some Orthic Humic Gleysols and some Orthic Gleysols.

Bfg, Bhfg, Btg, and others. When used in any of these combinations the limits set for f, hf, t, and others must be met.

Bgf The dithionite-extractable Fe of this horizon exceeds that of the IC by 1% or more. Pyrophosphate-extractable Al + Fe is less than the minimum limit specified for 'f' horizons. This horizon occurs in Fera Gleysols and Fera Humic Gleysols, and possibly below the Bfg of gleyed Podzols. It is distinguished from the Bfg of gleyed Podzols on the basis of the extractability of the Fe and Al. The Fe in the Bgf horizon is thought to have accumulated as a result of the oxidation of ferrous iron. The iron oxide formed is not associated intimately with organic matter or with Al, and it is sometimes crystalline. The Bgf horizons are usually prominently mottled, with more than half of the soil material occurring as mottles of high chroma.

Cg, Ckg, Ccag, Csg, Csag. When g is used with C alone, or with C and one of the lowercase suffixes k, ca, s, or sa, it must meet the definition for C and for the particular suffix.

h A horizon enriched with organic matter. It is used with A alone (Ah); or with A and e (Ahe); or with B alone (Bh); or with B and f (Bhf).

Ah A horizon enriched with organic matter that either has a color value at least one unit lower than the underlying horizon or contains 0.5% more organic carbon than the IC, or both. It contains less than 17% organic carbon by weight.

Ahe An Ah horizon that has undergone eluviation as evidenced, under natural conditions, by streaks and splotches of differing shades of gray and often by platy structure. It may be overlain by a darker-colored Ah and underlain by a lighter colored Ae.

Bh This horizon contains more than 1% organic carbon, less than 0.3% pyrophosphate-extractable Fe, and has a ratio of organic carbon to pyrophosphate-extractable of 20 or more. Generally the color value and chroma are less than 3 when moist.

Bhf Defined under 'f'.

j Used as a modifier of the suffixes e, f, g, n, and t to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies. For example Bfgj means a Bf horizon with weak expression of gleying; Bfjgj means a B horizon with weak expression of both 'f' and 'g' features.

Aej It denotes an eluvial horizon that is thin, discontinuous or slightly discernible.

Btj It is a horizon with some illuviation of clay, but not enough to meet the limits of Bt.

Btgj, Bmgj. Horizons that are mottled but do not meet the criteria of Bg.

Bfj It is a horizon with some accumulation of pyrophosphate-extractable Al and Fe but not enough to meet the limits of Bf.

Bntj or Bnj. Horizons in which development of solonetzic B properties is evident but insufficient to meet the limits for Bn or Bnt.

k Denotes the presence of carbonate, as indicated by visible effervescence when dilute HCl is added. Most often it is used with B and m (Bmk) or C (Ck), and occasionally with Ah or Ap (Ahk, Apk), or organic horizons (Ofk, Omk).

m A horizon slightly altered by hydrolysis, oxidation, or solution, or all three, to give a change in color or structure, or both. It has:

1. Evidence of alteration in one of the following forms:
    a) Higher chromas and redder hues than the underlying horizons.
    b) Removal of carbonates, either partially (Bmk) or completely (Bm).
2. Illuviation, if evident, too slight to meet the requirements of a Bt or a podzolic B.
3. Some weatherable minerals.
4. No cementation or induration and lacks a brittle consistence when moist. This suffix can be used as Bm, Bmgj, Bmk, and Bms.

n A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. It must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry. It is used with B, as Bn or Bnt.

p A horizon disturbed by man's activities, such as cultivation, logging, habitation, etc. It is used with A and O.

s A horizon with salts, including gypsum, which may be detected as crystals or veins, as surface crusts of salt crystals, by depressed crop growth, or by the presence of salt-tolerant plants. It is commonly used with C and k (Csk), but can be used with any horizon or combination of horizon and lowercase suffix.

sa A horizon with secondary enrichment of salts more soluble than calcium and magnesium carbonates, in which the concentration of salts exceeds that present in the unenriched parent material. The horizon is 10 cm or more thick. The conductivity of the saturation extract must be at least 4 ms/cm and must exceed that of the C horizon by at least onethird.

t An illuvial horizon enriched with silicate clay. It is used with B alone (Bt), with B and g (Btg), with B and n (Bnt), etc.

Bt A Bt horizon is one that contains illuvial layer lattice clays. It forms below an eluvial horizon, but may occur at the surface of a soil that has been partially truncated. It usually has a higher ratio of fine clay to total clay than IC. It has the following properties:

1. If any part of an eluvial horizon remains and there is no lithologic discontinuity between it and the Bt horizon, the Bt horizon contains more total and fine clay than the eluvial horizons, as follows:
    a) If any part of the eluvial horizon has less than 15% total clay in the fine earth fraction (2mm) the Bt horizon must contain at least 3% more clay, e.g., Ae 10% clay Bt minimum 13% clay.
    b) If the eluvial horizon has more than 15% and less than 40% total clay in the fine earth fraction, the ratio of the clay in the Bt horizon to that in the eluvial horizon must be 1.2 or more, e.g., 20% clay increase in the Bt over Ae.
    c) If the eluvial horizon has more than 40% total clay in the fine earth fraction, the Bt horizon must contain at least 8% more clay than the eluvial horizon, e.g. Ae 50% clay; Bt at least 58% clay.
2. A Bt horizon must be at least 5 cm thick. In some sandy soils where clay accumulation occurs in the lamellae, the total thickness of the lamellae should be more than 10 cm in the upper 150 cm of the profile.
3. In massive soils the Bt horizon should have oriented clays in some pores and also as bridges between the sand grains.
4. If peds are present, a Bt horizon shows clay skins on some of the vertical and horizontal ped surfaces and in the fine pores, or shows oriented clays in 1% or more of the cross section, as viewed in thin section.
5. If a soil shows a lithologic discontinuity between the eluvial horizon and the Bt horizon, or if only a plow layer overlies the Bt horizon, the Bt horizon need show only clay skins in some part, either in some fine

pores or on some vertical and horizontal ped surfaces. Thin sections should show that some part of the horizon has about 1% or more of oriented clay bodies.

Btj, Btj, and Btg are defined under j and g.

u A horizon that is markedly disrupted by physical or faunal processes other than cryoturbation. Evidence of marked disruption such as the inclusion of material from other horizons, absence of the horizon, etc. must be evident in at least half of the cross section of the pedon. Such turbation can result from blowdown of trees, mass movement of soil on slopes, and burrowing animals. It can be used with any horizon or subhorizon with the exception of A or B alone; e.g. Aeu, Bfu, BCu.

x A horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content. When dry, it has a hard consistence and seems to be cemented. When moist, it has moderate to weak brittleness. It frequently has bleached fracture planes and is overlain by a friable B horizon. Air dry clods of fragic horizons slake in water.

y A horizon affected by cryoturbation as manifested by disrupted and broken horizons, incorporation of materials from other horizons and mechanical sorting in at least half of the cross section of the pedon. It is used with A, B, and C alone or in combination with other subscripts, e.g. Ahy, Ahgy, Bmy, Cy, Cgy, Cygj, etc.

z A frozen layer. It may be used with any horizon or layer, e.g. Ohz, Bmz, Cz, Wz.

APPENDIX C

DESCRIPTION OF LANDFORMS

GENETIC MATERIALS

Unconsolidated mineral component

The unconsolidated mineral component consists of clastic sediments that may or may not be stratified, but whose particles are not cemented together. They are essentially of glacial or post-glacial origin but include poorly consolidated and weathered bedrock.

Anthropogenic - Man-made or man-modified materials, including those associated with mineral exploitation and waste disposal.

Colluvial - Massive to moderately well stratified, nonsorted to poorly sorted sediments with any range of particle sizes from clay to boulders and blocks that have reached their present position by direct, gravity-induced movement.

They are restricted to products of mass-wasting whereby the debris is not carried by wind, water, or ice (excepting snow avalanches).

Eolian - Sediment, generally consisting of medium to fine sand and coarse silt particle sizes, that is well sorted, poorly compacted,and may show internal structures such as cross bedding or ripple laminae, or may be massive. Individual grains may be rounded and show signs of frosting.

These materials have been transported and deposited by wind action.

Fluvial - Sediment generally consisting of gravel and sand with a minor fraction of silt and clay. The gravels are typically rounded and contain interstitial sand. Fluvial sediments are commonly moderately to well sorted and display stratification, but massive, nonsorted fluvial gravels do occur. These materials have been transported and deposited by streams and rivers. Finer textured Fluvial deposits of modern rivers are termed Alluvium.

Lacustrine - Sediment generally consisting of either stratified fine sand, silt, and clay deposited on the lake bed; or moderately well sorted and stratified sand and coarser materials that are beach and other nearshore sediments transported and deposited by wave action.

These are materials that either have settled from suspension in bodies of standing fresh water or have accumulated at their margins through wave action.

Marine - Unconsolidated deposits of clay, silt, sand, or gravel that are well to moderately well sorted and well stratified to moderately stratified (in some places containing shells). They have settled from suspension in salt or brackish water bodies or have accumulated at their margins through shoreline processes such as wave action and longshore drift.

Morainal - Sediment generally consisting of well compacted material that is nonstratified and contains a heterogeneous mixture of particle sizes, often in a mixture of sand, silt, and clay that has been transported beneath, beside, on, within and in front of a glacier and not modified by any intermediate agent.

Saprolite - Rock containing a high proportion of residual silts and clays formed by alteration, chiefly by chemical weathering.

The rock remains in a coherent state, interstitial grain relationships are undisturbed and no downhill movement due to gravity has occurred.

Undifferentiated - A layered sequence of more than three types of genetic material outcropping on a steep erosional escarpment.

Volcanic - Unconsolidated pyroclastic sediments. These include volcanic dust, ash, cinders, and pumice.

Qualifying Descriptors

These have been introduced to qualify the genetic materials and to supply additional information about the mode of formation or depositional environment.

Glacial - Used to qualify nonglacial genetic materials or process modifiers where there is direct evidence that glacier ice exerted a strong but secondary or indirect control upon the mode of origin of the materials or mode of operation of the process. The use of this qualifying descriptor implies that glacier ice was close to the site of the deposition of a material or the site of operation of a process.

Glaciofluvial - Fluvial materials showing clear evidence of having been deposited either directly in front of or in contact with glacier ice.

Glaciolacustrine - Lacustrine materials deposited in contact with glacial ice.

Glaciomarine - Materials of glacial origin laid down in a marine environment, as a result of settling from melting, floating ice and ice shelves.

Organic component

The organic component consists of peat deposits containing >30% organic matter by weight that may be as thin as 10 cm if they overlie bedrock but are otherwise greater than 40 cm and generally greater than 60 cm thick.
The classes and their definitions follow.

B	Bog
N	Fen
S	Swamp

Bog - A bog is a peat-covered or peat-filled area, generally with a high water table. Since the surface of the peatland is slightly elevated, bogs are either unaffected or partly aFfected by nutrientrich groundwaters from the surrounding mineral soils. The groundwater is generally acidic and low in nutrients (ombrotrophic). The dominant peat materials are sphagnum and forest peat, underlain, at times, by fen peat.

Fen - A fen is a peat-covered or peat-filled area with a high water table, which is usually at the surface. The dominant materials are shallow to deep, well to moderately decomposed fen peat. The waters are mainly rich in nutrients (minerotrophic) and are derived from mineral soils. The peat materials are therefore higher in both nutrients and pH than the peats associated with bogs.

Swamp - A swamp is a peat-covered or peat-filled area. The peat surface is level or slightly concave in cross section. The water table is frequently at or above the peat surface. There is strong water movement from margins or other mineral sources. The microrelief is hummocky, with many pools present. The waters are neutral or slightly acid. The dominant peat materials are shallow to deep mesic to humic forest and fen peat.

GENETIC MATERIAL MODIFIERS

Material modifiers are used to qualify unconsolidated mineral and organic deposits. Particle-size classes serve to indicate the size, roundness, and sorting of unconsolidated mineral deposits. Fiber classes indicate the degree of decomposition and fiber size of organic materials.

Particle size classes for unconsolidated mineral materials

Blocky:	An accumulation of angular particles greater than 256 mm in size.
Bouldery:	An accumulation of rounded particles greater than 256 mm in size.
Clayey:	An accumulation of particles where the fine earth fraction contains 35% or more clay (<0.002 mm) by weight and particles greater than 2 mm are less than 35% by volume.
Cobbly:	An accumulation of rounded particles having a diameter of 64-256 mm.
Gravelly:	An accumulation of rounded particles ranging in size from pebbles to boulders.
Loamy:	An accumulation of particles of which fine earth fraction contains 35% or less clay (<0.002 mm) by weight and particles greater than 2 mm are less than 35% by volume.
Pebbly:	An accumulation of rounded particles having a diameter of 2-64 mm.
Rubbly:	An accumulation of angular fragments having a diameter of 2-256 mm.
Sandy:	An accumulation of particles of which the fine earth fraction contains more than 70% by weight of fine sand or coarser particles. Particles greater than 2 mm occupy less than 35% by volume.

Silty:	An accumulation of particles of which the fine earth fraction contains less than 15% of fine sand or coarser particles and has less than 35% clay. Particles greater than 2 mm occupy less than 35% by volume.

Fiber classes for organic materials

The amount of fiber and its durability are important characterizing features of organic deposits in that they reflect on the degree of decomposition of the material. The prevalence of woody materials in peats is also of prime importance.

Fibric:	The least decomposed of all organic materials; there is a large amount of well preserved fiber that is readily identifiable as to botanical origin. Fibers retain their character upon rubbing.
Mesic:	Organic material in an intermediate stage of decompostion; intermediate amounts of fiber are present that can be identified as to their botanical origin.
Humic:	Highly decomposed organic material; small amounts of fiber are present that can be identified as to their botanical origin. Fibers can be easily destroyed by rubbing.
Woody:	Organic material containing more than 50% of woody fibers.

SURFACE EXPRESSION

The surface expression of genetic materials is their form (assemblage of slopes) and pattern of forms. Form as applied to unconsolidated deposits refers specifically to the product of the initial mode of origin of the materials. When applied to consolidated materials, form refers to the product of their modification by geological processes. Surface expression also indicates the manner in which unconsolidated genetic materials relate to the underlying unit.

Consolidated and Unconsolidated mineral surface classes

Apron - A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.

Blanket - A mantle of unconsolidated materials thick enough to mask minor irregularities in the underlying unit but still conforming to the general underlying topography.

Fan - A fan-shaped form similar to the segment of a cone and having a perceptible gradient from the apex to the toe.

Hammocky - A very complex sequence of slopes extending from somewhat rounded depressions or kettles of various sizes to irregular to conical knolls or knobs. There is a general lack of concordance between knolls or depressions. Slopes are generally 9-70% (5-35 degrees).

Inclined - A sloping, unidirectional surface with a generally constant slope not broken by marked irregularities. Slopes are 2-70% (1-35 degrees). The form of inclined slopes is not related to the initial mode of origin of the underlying material.

Level - A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than 2% (1 degree).

Rolling - A very regular sequence of moderate slopes extending from rounded, sometimes confined concave depressions to broad, rounded convexities producing a wavelake pattern of moderate relief. Slope length is often 1.6 km or greater and gradients are greater than 5% (3 degrees).

Ridged - A long, narrow elevation of the surface, usually sharp crested with steep sides. The ridges may be parallel, subparallel, or intersecting.

Steep - Erosional slopes, greater than 70% (35 degrees), on both consolidated and unconsolidated materials. The form of a steep erosional slope on unconsolidated materials is not related to the initial mode of origin of the underlying material.

Terraced - Scarp face and the horizontal or gently inclined surface (tread) above it.

Undulating - A very regular sequence of gentle slopes that extends from rounded, sometimes confined concavities to broad rounded convexities producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant gradient of slopes is 2-5% (1-3 degrees).

Veneer - Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer will range from 10 cm to 1 m in thickness and will possess no form typical of the material's genesis.

Organic surface classes

Blanket - A mantle of organic materials that is thick enough to maskminor irregularities in the underlying unit but still conforms to the general underlying topography.

Bowl - A bog or fen occupying concave-shaped depressions.

Domed - A bog with an elevated, convex, central area much higher than the margin. Domes may be abrupt (with or without a frozen core) or gently sloping or have a stepped surface.

Floating - A level organic surface associated with a pond or lake and not anchored to the lake bottom.

Horizontal - A flat peat surface not broken by marked elevations and depressions.

Plateau - A bog with an elevated, flat, central area only slightly higher than the margin.

Ribbed - A pattern of parallel or reticulate low ridges associated with fens.

Sloping - A peat surface with a generally constant slope not broken by marked irregularities.

Veneer - A thin (40 cm-1m) mantle of organic materials which generally conforms to the underlying topography. They may or may not be associated with discontinuous permafrost.

APPENDIX D

GUIDES FOR EVALUATING SOIL SUITABILITY FOR SELECTED USES

Table 11. Land Classification Standards for Irrigation Suitability

Land Characteristics	Subclass	Class 1 - Very Good	Class 2 - Good	Class 3 - Fair	Class 4 - Poor
SOILS	S				
Texture					
very coarse textured very fine textured	v h	Fine sandy loams to clay loams	Loamy fine sand to light clay	Sand to permeable clay	Gravel to clay
Water holding capacity low available moisture capacity	q	40 to 60 sat. % >15cm storage in 1.2m <10cm/hr. hydraulic cond.	35 to 65 sat. % >12.5cm storage in 1.2m <12.5cm/hr. hydraulic cond.	25 to 75 sat. % >7.5cm storage in 1.2m <17.5cm/hr. hydraulic cond.	<25 or >75 sat. % <7.5cm storage in 1.2m >17.5cm/hr. hydraulic cond.
Geological Deposit shallow deposit over sand or gravel	k	.9m or more of fine sandy loam or heavier	.6m or more of fine sandy loam or heavier, or .75m plus of loamy fine sand or sandy loam	.5m or more of sandy loam or heavier, or .6m plus of loamy sand	<.5m of sandy loam or heavier, or .6m of loamy sand or sand
shallow deposit over impervious substrata	b	>3m of permeable material	>2m of permeable material	>1m of permeable material	<1m of permeable material
Salinity and Alkalinity^{1,2}	a	<4 mm/cm in 0-.6m <8 mm/cm below .6m <6 S.A.R.	<4 mm/cm in 0-.6m <12 mm/cm below .6m <8 S.A.R.	<8 mm/cm in 0-.6m <15 mm/cm below .6m <12 S.A.R.	>8 mm/cm in 0-.6m >15 mm/cm below .6m >12 S.A.R.
EXTERNAL FEATURES					
Stones - rock clearing	r	None to light clearing	Light to medium clearing	Light to heavy clearing	Excessively stony
Topography	T				
Slope excess gradient	g	<1% and 0.1% in general gradient (0-3% slope)	<3% in general gradient (3-5% slope)	<5% in general gradient (5-10% slope)	>5% in general* gradient (>10% slope)**
DRAINAGE	D				
restricted outlet		No problem anticipated	Moderate drainage problem anticipated but may be improved at relatively low cost	Moderate to severe drainage problem anticipated but may be improved by expensive but feasible measures	Drainage improvement not considered feasible
water table		below 2.4m most of year	could be above 1.5m for a short period, then recedes to 2.4m or lower	within 1.5m most of year	within 1m most of year

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* Criteria for gravity (flood) irrigation requirements.

** Estimated adjustments to slope criteria for overhead or sprinkler type irrigation methods.

[1] If sufficient gypsum is present in the soil, the S.A.R. may be lowered by leaching the soil (a very slow process), and the hydraulic conductivity may then improve.

[2] The degree of salinity may vary widely within short distances, and there may be no clear indication of the area occupied by each salinity class. Unless a very detailed mapping and sampling program is carried out, it is impossible to estimate the acreage occupied by each salinity class.

Table 12. Guide for assessing soil suitability as source of topsoil

The term "topsoil" includes soil materials used to cover barren surfaces exposed during construction, and materials used to improve soil conditions on lawns, gardens, flower beds, etc. The factors to be considered include not only the characteristics of the soil itself, but also the ease or difficulty of excavation, and where removal of topsoil is involved, accessibility to the site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence[2]	Very friable, friable	Loose, firm	Very firm	Cemented
i	Flooding	None	May flood occasionally for short periods	Frequent flooding	Constantly flooded
w	Wetness[2]	Wetness is not determining if better than very poorly drained.			Very poorly drained and permanently wet soils
t	Slope	0-5%	5-9%	9-15%	>15%
p	Stoniness[2]	Stones 10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones 0.1 m apart (Class 5)
c	Coarse fragments[2]: percent, by volume	<3%	3-15%	15-35%	>35%
s	Texture[2]	FSL, VFSL, L, SiL, SL, SC if 1:1 clay is dominant	CL, SCL, SiCL, SC if 2:1 clay is dominant; c and sic if 1:1 clay is dominant	S, LS, C and SiC if 2:1 clay is dominant. organic soils[3]	Marl, diatomaceous earth
b	Depth of Topsoil[4]	>40 cm	15-40 cm	8-15 cm	<8 cm
n	Salinity of Topsoil[5]	E.C. 0-1	E.C. 1-4	E.C. 4-8	E.C. >8

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[1] The symbols are used to indicate the nature of the limitation.

[2] For an explanation of texture, consistence, stoniness, coarse fragments and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3] Non-woody organic materials are assessed as good sources for topsoil if mixed with or incorporated into mineral soil.

[4] The remaining soil material (at least 8 cm) must be reclaimable after the uppermost soil is removed.

[5] E.C. = Electrical Conductivity (millisiemens/cm).

Table 13. Guide for assessing soil suitability as source of sand and gravel

The purpose of this table is to provide guidance for assessing the probable supply as well as quality of the sand or gravel for use as road base material and in concrete. The interpretation pertains mainly to the characteristics of the soil substratum to a depth of 150 cm, augmented by observations made in deep cuts as well as geological knowledge where available.

Symbol[1/]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Unified Soil Group	SW SP GW GP	SW-SM SP-SM GP-GM GW-GM	SM SW-SC SP-SC GM GP-GC GW-GC	All other groups and bedrock
h	Depth to Seasonal Water Table	Not class determining if deeper than 50 cm		50 cm	
q	Depth to Sand and Gravel	<25 cm	25-75 cm[2/]	>75 cm[2/]	
p	Stoniness[3/]	Not class determining if stones >.5 m apart (Class 0, 1, 2 and 3)		Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
d	Depth to Bedrock	>100 cm	50-100 cm	<50 cm	

[1/] The symbols are used to indicate the nature of the limitation.

[2/] Rated good if it is known that the underlying gravel or sand deposit is thick (>100 cm).

[3/] For an explanation of stoniness and rockiness, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

Table 14. Guide for assessing soil suitability as source of roadfill

Fill material for buildings or roads are included in this use. The performance of the material when removed from its original location and placed under load at the building site or road bed are to be considered. Since surface materials are generally removed during road or building construction their properties are disregarded. Aside from this layer, the whole soil to a depth of 150-200 cm should be evaluated. Soil materials which are suitable for fill can be considered equally suited for road subgrade construction.

Symbol[1]	Items Affecting Use[2]	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Subgrade[3]				
	a. AASHO group index[4]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC[5] and SC[5]	CL (with P.I.[6] <15) and ML	CL (with P.I.[6] of 15 or more), CH and MH[7]	OL, OH and Pt
l	Shrink-swell potential	Low	Moderate	High	
f	Susceptibility to frost action[8]	Low	Moderate	High	
t	Slope	0-15%	15-30%	30-45%	>45%
p	Stoniness[9]	Stones >2 m apart (Class 0, 1 and 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[9]	Rock exposures >35 m apart and cover <10% of the surface	Rock exposure 10-35 m apart and cover 10-25% of the surface	Rock exposure 3.5-10 m apart and cover 25-50% of the surface	Rock exposures <3.5 m apart and cover 50-90% of the surface
w	Wetness[9]	Excessively drained to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
d	Depth to Bedrock	>100 cm	50-100 cm	20-50 cm	<20 cm
h	Depth to Seasonal Water Table	>150 cm	75-150 cm	50-75 cm	<50 cm

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[1] The symbols are used to indicate the nature of the limitation.

[2] The first three items pertain to soil after it is placed in a fill; the last six items pertain to soil in its natural condition before excavation for road fill.

[3] This item estimates the strength of the soil material, that is, its ability to withstand applied loads.

[4] Use AASHO group index only where laboratory data are available for the kind of soil being rated; otherwise, use Unified soil groups.

[5] Downgrade suitability rating to fair if content of fines is more than about 30 percent.

[6] P.I. means plasticity index.

[7] Upgrade suitability rating to fair if MH is largely kaolinitic, friable, and free of mica.

[8] Use this item only where frost penetrates below the paved or hardened surface layer and where moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front.

[9] For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

Table 15. Guide for assessing soil suitability for permanent buildings

This guide applies to undisturbed soils to be evaluated for single-family dwellings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundation requirements; but soil slope, susceptibility to flooding and other hydrologic conditions, such as wetness, that have effects beyond those related exclusively to foundations are considered too. Also considered are soil properties, particularly depth to bedrock, which influence excavation and construction costs for the building itself and for the installation of utility lines. Excluded are limitations for soil corrosivity, landscaping and septic tank absorption fields.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability[3]			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[4]	With Basements: Very rapidly, rapidly and well drained. Without Basements: Very rapidly, rapidly, well and moderately well drained.	With Basements: Moderately well drained. Without Basements: Imperfectly drained.	With Basements: Imperfectly, poorly, and very poorly drained. Without Basements: Poorly and very poorly drained.	With Basements: Permanently wet soils. Without Basements: Permanently wet soils.
h	Depth to Seasonal Water Table	With Basements: >150 cm Without Basements: >75 cm	With Basements: 75-150 cm Without Basements: 50-75 cm	With Basements: 25-75 cm Without Basements: 25-50 cm	With Basements: <25 cm Without Basements: <25 cm
i	Flooding	None	None	Occasional flooding (once in 5 years)	Frequent flooding (every year)
t	Slope[5]	0-9%	9-15%	15-30%	>30%
s	Subgrade[6]				
	a. AASHO group index[7]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM and GC and SC	CL (with P.I.[8] <15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and Pt
f	Potential Frost Action[9]	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness[4]	Stones >10 m apart (Class 0 to 1)	Stones 2-10 m apart (Class 2[10])	Stones 0.1-2 m apart (Class 3[10] to 4)	Stones <0.1 m apart (Class 5[10])
r	Rockiness[4], [11]	Rock exposures >100 m apart and cover <2% of the surface	Rock exposures 30-100 m apart and cover 2-10% of the surface	Rock exposures <30 m apart and cover >10% of the surface	Rock exposures too frequent to allow location of permanent buildings
d	Depth to Bedrock[11]	With Basements: >150 cm Without Basements: >100 cm	With Basements: 100-150 cm Without Basements: 50-100 cm	With Basements: 50-100 cm Without Basements: <50 cm	With Basements: <50 cm

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[1] By halving the slope limits, this table can be used for evaluating soil suitability for buildings with large floor areas, but with foundation requirements not exceeding those of ordinary three-storey dwellings.

[2] The symbols are used to indicate the nature of the limitation.

[3] Some soils assessed as fair or poor may be good sites from an aesthetic or use standpoint, but they will require more site preparation and/or maintenance.

[4] For an explanation of rockiness, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Reduce the slope limits by one half for those soils subject to hillside slippage.

[6] This item estimates the strength of the soil, that is, its ability to withstand applied loads. When available, AASHO Group Index values from laboratory tests were used; otherwise the estimated Unified classes were used.

[7] Group index values were estimated from information published by the Portland Cement Association (PCA, 1962), pp. 23-25.

[8] P.I. means plasticity index.

[9] Frost heave only applies where frost penetrates to the assumed depth of the footings and the soil is moist. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5-8.

[10] Rate one class better for buildings without basements.

[11] Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment such as backhoes.

Table 16. Guide for assessing soil suitability for local roads and streets

This guide applies to soils to be evaluated for construction and maintenance of local roads and streets. These are improved roads and streets having some kind of all-weather surfacing, commonly asphalt or concrete, and are expected to carry automobile traffic all year. They consist of: (1) the underlying local soil material (either cut or fill) called the subgrade; (2) the base material of gravel, crushed rock, or lime or soil cement stabilized soil called the subbase; and (3) the actual road surface or pavement, either flexible or rigid. They also are graded to shed water and have ordinary provisions for drainage. With the probable exception of the hardened surface layer, the roads and streets are built mainly from the soil at hand, and cuts and fills are limited, usually less than 2 meters. Excluded from consideration in this guide are highways designed for fast-moving, heavy trucks.

Properties that affect design and construction of roads and streets are: (1) those that affect the load supporting capacity and stability of the subgrade, and (2) those that affect the workability and amount of cut and fill. The AASHO and Unified Classification give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of hardrock, stoniness, rockiness, and wetness affect the ease of excavation and the amount of cut and fill to reach an even grade.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[3]	Very rapidly, rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained	Permanently wet soils
i	Flooding	None	Infrequent (once in 5 years)	Occasional (once in 2-4 years)	Frequent (every year)
t	Slope	0-9%	9-15%	15-30%	>30%
d	Depth to Bedrock[4]	>100 cm	50-100 cm	<50 cm	
s	Subgrade[5]				
	a. AASHO group index[6]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC[7] and SC[7]	CL (with P.I.[8] <15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and Pt
f	Susceptibility to Frost Heave[9]	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness[3]	Stones >2 m apart (Class 0 to 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[3]	Rock exposures >100 m apart and cover <2% of the surface	Rock exposures 30-100 m apart and cover 2-10% of the surface	Rock exposures <30 m apart and cover >10% of the surface	Rock exposures too frequent to permit location of roads and streets

[1] These guidelines, with some adjustment of slope and rockiness limits, will also be useful for assessing soils for use as parking lots.

[2] Symbols are used to indicate the nature of the limitation.

[3] For an explanation of stoniness, rockiness and soil drainage classes, see the Canada Soil Information System (Canada Soil Survey Committee, 1978).

[4] Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment and is rippable by machinery.

[5] This item estimates the strength of soil materials as it applies to roadbeds. When available, AASHO Group Index values from laboratory tests were used; otherwise, the estimated Unified classes were used. The limitations were estimated assuming that the roads would be surfaced. On unsurfaced roads, rapidly drained, very sandy, poorly graded soils may cause washboard or rough roads.

[6] Group index values were estimated from information published by the Portland Cement Association (PCA, 1962) pp. 23-25.

[7] Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30 percent.

[8] P.I. means plasticity index.

[9] Frost heave is important where frost penetrates below the paved or hardened surface layer and moisture transportable by capillary movement is sufficient to form ice lenses at the freezing point. The susceptibility classes are taken from the United States Army Corps of Engineers (1962) pp. 5-8.

Table 17. Guide for assessing soil suitability for trench-type sanitary landfills

The trench-type sanitary landfill is a sanitary landfill, in which dry garbage and trash is buried daily in an open trench and covered with a layer of soil material. Suitability of the site is dependent upon the potential for pollution of water sources through groundwater contact with the refuse, or leachate arising from the site. Those properties affecting ease of excavation of the site must be supplemented with geological and hydrological knowledge to provide subsurface soil and groundwater data to a depth of at least 3 to 4.5 m, a common depth of landfills.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability			
		Good - G[3]	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal High Water Table	Not class determining if more than 180 cm		100-180 cm	<100 cm
w	Wetness[4]	Not class determining if better than imperfectly drained		Imperfectly drained	Poorly and very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional	Frequent
k	Permeability[5]	<5 cm/hr	<5 cm/hr	5-15 cm/hr	>15 cm/hr
t	Slope	0-15%	15-30%	30-45%	>45%
s	Soil Texture[4],[6] (dominant to a depth of 150 cm)	SL, L, SiL, SCL	SiCL[7], CL, SC, LS	SiC, C	Muck, peat, gravel, sand
d	Depth to Hard Bedrock Rippable	>150 cm >150 cm	>150 cm 100-150 cm	100-150 cm 100-150 cm	<100 cm <100 cm
p	Stoniness[4]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones <0.1 m apart (Class 5)
r	Nature of Bedrock	Impermeable			Highly permeable, fractured, easily soluble

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[1] Based on soil depth (120 cm) commonly investigated in making soil surveys.

[2] The symbols are used to indicate the nature of the limitation.

[3] If probability is high that the soil material to a depth of 3 to 4.5 m will not alter a rating of good or fair, indicate this by an appropriate footnote, such as "Probably good to a depth of 3.5 m", or "Probably fair to a depth of 3.5 m".

[4] For an explanation of stoniness, texture and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Reflects ability of soil to retard movement of leachate from the landfills; may not reflect a limitation in arid and semiarid areas.

[6] Reflects ease of digging and moving (workability) and trafficability in the immediate area of the trench where there may not be surfaced roads.

[7] Soils high in expansive clays may need to be given a suitability rating of poor.

Table 18. Guide for assessing soil suitability for area-type sanitary landfills

In the area-type sanitary landfill refuse is placed on the surface of the soil in successive layers. The daily and final cover material generally must be imported. A final cover of soil material at least 60 cm thick is placed over the fill when it is completed.

The soil under the proposed site should be investigated so as to determine the probability that leachates from the landfill can penetrate the soil and thereby pollute water supplies.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal Water Table[2]	> 150 cm	150-100 cm	50-100 cm	<50 cm
w	Wetness[2],[3]	Rapid to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional	Frequent
k	Permeability[4],[5]	Not class determining if less than 5 cm/hr		5-15 cm/hr	>15 cm/hr
t	Slope	0-9%	9-15%	15-30%	>30%

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[1] The symbols are used to indicate the nature of the limitation.

[2] Reflects influence of wetness on operation of equipment.

[3] For an explanation of drainage, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[4] Reflects ability of the soil to retard movement of leachate from landfills; may not reflect a limitation in arid and semiarid areas.

[5] Due to possible groundwater contamination, impermeable bedrock is considered poor and permeable bedrock is rated very poor for area-type sanitary landfills.

Table 19. Guide for assessing soil suitability as cover material for area-type sanitary landfills

The term cover material includes soil materials used to put a daily and final covering layer on refuse in area-type sanitary landfills. This cover material may be derived from the area of the landfill or may be brought in from surrounding areas.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence[2]	Very friable, friable	Loose, firm	Very firm	Cemented
s	Texture[2],[3]	SL, L, SiL, SCL	SiCL, CL, SC, LS	SiC, C	Muck, peat, sand, gravel
d	Depth to bedrock[4]	>150 cm	100-150 cm	50-100 cm	<50 cm
c	Coarse fragments[2]	<15%	15-35%	>35%	
p	Stoniness[2]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
t	Slope	<9%	9-15%	15-30%	>30%
w	Wetness[2]	Not class determining if better than poorly drained		Poorly drained	Very poorly drained or permanently wet soils

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[1] The symbols are used to indicate the nature of the limitation.

[2] For an explanation of consistence, texture, coarse fragments, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3] Soils having a high proportion of non-expansive clays may be given a suitability rating one class better than is shown for them in this table.

[4] Thickness of material excluding topsoil, which will be stockpiled (see guide for topsoil).

Table 20. Guide for assessing soil suitability for reservoirs and sewage lagoons

Factors affecting the ability of undisturbed soils to impound water or sewage and prevent seepage are considered for evaluating soils on their suitability for reservoir and lagoon areas. This evaluation considers soil both as a vessel for the impounded area and as material for the enclosing embankment. As the impounded liquids could be potential sources of contamination of nearby water supplies, e.g. sewage lagoons, the landscape position of the reservoir as it affects risk of flooding must also be considered.

Symbol[1]	Item Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Water Table[2]	>150 cm	100-150 cm	50-100 cm	<50 cm
i	Flooding[3]	None	None	Subject to infrequent flooding (once in 50 years)	Subject to frequent high level flooding
k	Soil Permeability	0-0.5 cm/hr	0.5-5 cm/hr	5-15 cm/hr	>15 cm/hr
t	Slope	0-2%	2-5%	5-9%	>9%
o	Organic Matter	<2%	2-10%	10-30%	>30%
c	Coarse Fragments[4] <25 cm in diameter, % by volume	<20%	20-35%	>35%	
p	Stoniness[4], >25 cm diameter, percent of surface area	<3% (Class 0, 1 and 2)	3-15% (Class 3)	15-50% (Class 4)	>50% (Class 5)
d	Depth to Bedrock[5]	>150 cm	100-150 cm	50-100 cm	<50 cm
j	Thickness of Slowly Permeable Layer	>100 cm	50-100 cm	50-25 cm	<25 cm
a	Subgrade Unified Soil Classes	GC, SC, CL, & CH	GM, ML, SM & MH	SW & SP	OL, OH & Pt GP, GW

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[1] The symbols are used to indicate the nature of the limitation.

[2] If the floor of the lagoon has nearly impermeable material at least 50 cm thick, disregard depth to water table.

[3] Disregard flooding if it is not likely to enter or damage the lagoon (flood waters have low velocity and depth less than 150 cm).

[4] For an explanation of coarse fragments and stoniness classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Surface exposures of non rippable rock are rated very poor. If underlying bedrock is impermeable, rating should be one class better.

Table 21. Guide for assessing soil suitability for septic tank absorption fields

This guide applies to soils to be used as an absorption and filtering medium for effluent from septic tank systems. A subsurface tile system laid in such a way that effluent from the septic tank is distributed reasonably uniformly into the natural soil is assumed when applying this guide. A rating of poor need not mean that a septic system should not be installed in the given soil, but rather, may suggest the difficulty, in terms of installation and maintenance, which can be expected.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
k	Permeability[2]	Rapid to moderately rapid	Moderate	Slow	Very slow
	Percolation Rate[3] (Auger hole method)	About 8-18 min/cm[3]	18-24 min/cm	Slower than 24 min/cm	
h	Depth to Seasonal Water Table[4]	>150 cm[5]	100-150 cm	50-100 cm	<50 cm
i	Flooding	Not subject to flooding	Not subject to flooding	Subject to occasional flooding (once in 5 years)	Floods every year
t	Slope	0-9%	9-15%	15-30%	>30%
d	Depth to Hard Rock, bedrock or other impervious materials	>150 cm	100-150 cm[6]	50-100 cm	<50 cm

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[1] The symbols are used to indicate the nature of the limitation.

[2] The suitability ratings should be related to the permeability of soil layers at and below depth of the tile line.

[3] Soils having a percolation rate less than about 8 min/cm are likely to present a pollution hazard to adjacent waters. This hazard must be noted, but the degree of hazard must, in each case, be assessed by examining the proximity of the proposed installation to water bodies, water table, and related features. The symbol g is used to indicate this condition. Refer to U.S. Dept. of Health, Education and Welfare (1969) for details of this procedure.

[4] Seasonal means for more than one month. It may, with caution, be possible to make some adjustment for the severity of a water table limitation in those cases where seasonal use of the facility does not coincide with the period of high water table.

[5] A seasonal water table should be at least 100 cm below the bottom of the trench at all times for soils rated Good (U.S. Dept. of Health, Education and Welfare, 1969). The depths used to water table are based on an assumed tile depth of 50 cm. Where relief permits, the effective depth above a water table or rock can be increased by adding appropriate amounts of fill.

[6] Where the slope is greater than 9%, a depth to bedrock of 100-150 cm is assessed as poor.

Table 22. Guide for assessing soil suitability for playgrounds

This guide applies to soils to be used intensively for playgrounds for baseball, football, badminton, and for other similar organized games. These areas are subject to intensive foot traffic. A nearly level surface, good drainage, and a soil texture and consistence that gives a firm surface generally are required. The most desirable soils are free of rock outcrops and coarse fragments.

Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Rapidly, well and moderately well drained soils with no ponding or seepage. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding of short duration and imperfectly drained soils. Water table below 50 cm during season of use.	Imperfectly drained soils subject to seepage or ponding, and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None during season of use.	Occasional flooding. May flood once every 2-3 years during season of use.	Floods every year during season of use.	Prolonged flooding during season of use.
k	Permeability	Very rapid to moderate.	Moderately slow and slow.	Very slow.	
t	Slope	0-2%	2-5%	5-9%	>9%
d	Depth to Bedrock	>100 cm	50-100 cm[3]	<50 cm[3]	
b	Coarse fragments on surface[2]	Relatively free of coarse fragments.	<20% coarse fragments.	>20% coarse fragments.	
p	Stoniness[2]	Stones >10 m apart. (Class 0 to 1)	Stones 2-10 m apart. (Class 2)	Stones 0.1-2 m apart. (Class 3, 4)	Stones <0.1 m apart. (Class 5)
r	Rockiness[2]	Rock exposures >100 m apart and cover <2% of the surface.	Rock exposures 30-100 m apart and cover about 2-10% of the surface.	Rock exposures <30 m apart and cover >10% of the surface.	Rock outcrops too frequent to permit playground location.
s	Surface Soil Texture[2],[4]	SL, FSL, VFSL, L	SiL, CL, SCL, SiCL, LS	SC, SiC, C[5]; S, Si	Peaty soils; S and LS subject to blowing.
q	Depth to Sand or Gravel[6]	>100 cm	50-100 cm	<50 cm	
m	Useful Moisture[7]	Water storage capacity[8] >15.0 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5-15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] <7.5 cm and/or low rainfall and/or high evapotranspiration.	

[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).
Coarse fragments for the purpose of this table include gravels and cobbles.

[3] Downgrade to a very poor suitability rating if the slope is greater than 5%.

[4] Surface soil texture influences soil ratings as it affects foot trafficability, surface wetness, dust, and maintenance. Adverse soil textures may be partially or completely overcome with the addition of topsoil.

[5] Moderately well and well drained SC, SiC and C soils may be rated fair.

[6] Depth to sand or gravel is considered a limitation in that levelling operations may expose sand or gravel, thereby bringing about adverse surface textures and undesirable amounts of coarse fragments. The addition of topsoil after the levelling process would overcome this limitation.

[7] This item attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

[8] Consult glossary for definitions of terms used.

Table 23. Guide for assessing soil suitability for picnic areas

This guide applies to soils considered for intensive use as park-type picnic areas. It is assumed that most vehicular traffic will be confined to the access roads. Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Very rapidly, rapidly, well and moderately well drained soils not subject to seepage or ponding. Water table below 50 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding and imperfectly drained soils not subject to ponding or seepage. Water Table above 50 cm for short periods during season of use.	Imperfectly drained soils subject to seepage or ponding. Poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None during season of use.	May flood 1 or 2 times per year for short periods during season of use.	Floods more than 2 times during season of use.	Prolonged flooding during season of use.
t	Slope	0-9%	9-15%	15-30%	>30%
s	Surface Soil Texture[2],[3]	SL, FSL, VFSL, L	SiL, CL, SCL, SiCL, LS, and sand other than loose sand.	SC, SiC, C[4]; Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface[2]	0-20%	20-50%	>50%	
p	Stoniness[2]	Stones >2 m apart (Class 0 to 2)	Stones 1-2 m apart (Class 3)	Stones 0.1-1 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness[2],[5],[6]	Rock exposures roughly 30-100 or more m apart and cover < 10% of the surface.	Rock exposures roughly 10-30 m apart and cover 10-25% of the surface.	Rock exposures < 10 m apart and cover >25% of the surface.	Rock exposures too frequent to permit location of picnic areas.
m	Useful Moisture[7]	Water storage capacity[8] >15 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5-15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] <7.5 cm and/or low rainfall and/or high evapotranspiration.	

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[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978). Coarse fragments for the purpose of this table, include gravels and cobbles. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.

[3] Surface soil texture influences soil ratings as it affects foot trafficability, dust and soil permeability.

[4] Moderately well and well drained SC, SiC and C soils may be rated fair.

[5] Very shallow soils are rated as having severe or very severe limitations for stoniness or rockiness.

[6] The nature and topography of the bedrock exposures may significantly alter these ratings. As such, on-site investigations will be necessary in map units containing bedrock when these are considered as possible sites.

[7] This item attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

[8] Consult glossary for definitions of terms used.

Table 24. Guide for assessing soil suitability for camp areas

This guide applies to soils to be used intensively for tents and camp trailers and the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping and levelling for campsites and parking areas. The soil should be suitable for heavy foot traffic by humans and limited vehicular traffic. Soil suitability for growing and maintaining vegetation is not a part of this guide, but is an important item to consider in the final evaluation of site.

Back country campsites differ in design, setting and management but require similar soil attributes. These guides should apply to evaluations for back country campsites but depending on the nature of the facility the interpreter may wish to adjust the criteria defining a given degree of limitation to reflect the changed requirement. For example, small tentsites may allow rock exposures greater than 10 m apart to be considered a slight limitation.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Very rapidly, rapidly, well and moderately well drained soils with no seepage or ponding. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding and imperfectly drained soils with no seepage or ponding. Water table below 50 cm during season of use.	Imperfectly drained soils subject to seepage or ponding and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None	Very occasional flooding during season of use. Once in 5-10 years.	Occasional flooding during season of use. Once in 2-4 years.	Flooding during every season of use.
k	Permeability	Very rapid to moderate inclusive.	Moderately slow and slow.	Very slow.	
t	Slope	0-9%	9-15%	15-30%	>30%
e	Surface Soil Texture[2,3]	SL, FSL, VFSL, L	SiL, SCL, CL, SiCL, LS, and sand other than loose sand.	SC, SiC, C[4]; Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface[2,5]	0-20%	20-50%	>50%	
p	Stoniness[2,6]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness[2,6]	No rock exposures	Rock exposures >10 m apart and cover <25% of the area.	Rock exposures <10 m apart and cover >25% of the area.	Rock exposures too frequent to permit campground location.

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[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3] Surface soil texture influences soil ratings as it affects foot trafficability, dust, and soil permeability.

[4] Moderately well and well drained SC, SiC and C soils may be rated fair.

[5] Coarse fragments for the purpose of this table include gravels and cobbles. Some gravelly soils may be rated as having slight limitations if the content of gravel exceeds 20% by only a small margin, providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.

[6] Very shallow soils are rated as having a limitation for rockiness and/or stoniness.

Table 25. Guide for assessing soil suitability for paths and trails

It is assumed that the trails will be built at least 45 cm wide and that obstructions such as cobbles and stones will be removed during construction. It is also assumed that a dry, stable tread is desirable and that muddy, dusty, worn or eroded trail treads are undesirable. Hiking and riding trails are not treated separately, but as the design requirements for riding trails are more stringent, a given limitation will be more difficult to overcome. Poor or very poor suitability does not indicate that a trail cannot or should not be built. It does, however, suggest higher design requirements and maintenance to overcome the limitations.

Symbol[1]	Items[2] Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Texture[3],[4]	SL, FSL, VFSL, LS, L	SiL, CL, SiCL, SCL	SC, SiC, C[5]; Sand, Si	Peaty soils; loose sand subject to blowing
c	Coarse Fragment Content[4],[6]	0-20%	20-50%	>50%	
p	Stoniness[4]	Stones >2 m apart (Class 0 to 2)	Stones 1-2 m apart (Class 3)	Stones 0.1-1 m apart (Class 4)	Stones <0.1 m apart (Class 5)
w	Wetness[4]	Very rapidly, rapidly well, and moderately well drained soils. Water table below 50 cm during season of use.	Moderately well drained soils subject to occasional seepage and ponding and imperfectly drained soils. Water table may be above 50 cm for short periods during season of use.	Poorly and very poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Permanently wet soils.
r	Rockiness[4],[7]	Rock exposures >30 m apart and cover <10% of the surface.	Rock exposures 10-30 m apart and cover 10-25% of the surface.	Rock exposures <10 m apart and cover >25% of the surface.	Rock exposures too frequent to permit location of paths and trails.
t	Slope[8]	0-15%	15-30%	30-60%	>60%
i	Flooding	Not subject to flooding during season of use.	Floods 1 or 2 times during season of use.	Floods more than 2 times during season of use.	Subject to prolonged flooding during season of use.

[1] The symbols are used to indicate the nature of the limitation.

[2] The items affecting use listed in this table are those which have been shown to cause significant differences in trail response. Elevation, aspect, position on slope, and snow avalanching may have slight affects or influence trail management and should be considered in the final site evaluation. Items such as vegetation, fauna, and scenic value are not considered in the guidelines (Epp, 1977).

[3] Texture refers to the soil texture which will form the tread texture. This is the surface texture on level areas but may be a subsurface texture on slopes. Textural classes are based on the less than 2 mm soil fraction. Texture influences soil ratings as it influences foot trafficability, dust, design or maintenance of trails, and erosion hazards.

[4] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Moderately well and well drained SC, SiC and C soils may be rated fair.

[6] Coarse fragments for the purpose of this table, include gravels and cobbles. Gravels tend to cause unstable footing when present in high amounts, and are also associated with increased erosion. Cobbles (and stones) must be removed from the trail tread, increasing construction and maintenance difficulties. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix or (b) the fragments are less than 2 cm in size.

[7] The type of rock outcrop (flat lying vs cliffs), and the orientation of the structure (linear cliffs vs massive blocks) can greatly alter the degree of the limitation. Each site with a Rockiness limitation based on the percent rock outcrop above should be evaluated on its own merits and the degree of limitation should then be modified appropriately if necessary.

[8] Slope in this context refers to the slope of the ground surface, not the slope of the tread.

APPENDIX E

CORRELATION OF THE SOIL SERIES DESCRIPTIONS FROM THE SOIL SURVEY OF THE RURAL MUNICIPALITY OF NORTH NORFOLK

The detailed resurvey of the Rural Municipality of North Norfolk replaces a portion of the reconnaissance soil survey of the Carberry Map Sheet Area (1957). This resurvey benefits from more intensive field examination of soils and larger map scale formats which permit the delineation of more soil detail not possible on reconnaissance (1:126,720 scale) soil maps.

The reconnaissance mapping utilized broadly defined soil groupings called "Soil Associations" consisting of related but unlike soils which occur in characteristic landscape patterns on similar parent material. These related soils, called "soil associates" occupy different positions in the landscape and differ in profile because of local influences of topography, drainage and vegetation. Individual soil associates can occupy large continuous land areas, but more commonly occupy small areas and occur in complex patterns with other associates.

Soil associates that have similar profile characteristics but vary in some physical feature important to agricultural use, are classified as phases of associates. Recognition of soil phases is based on such external features as topography, stoniness or the presence of an unconforming subsurface parent material charateristic. These phases are now recognized as phases of soil series or are of significant extent and importance to be classified as separate soil series.

A taxonomic classification unit approximately equivalent to soil associates called "soil series" is used in the resurvey as the basic taxonomic unit and as the map delineation identifier. In general, the allowable range in variation of soil profile characteristics is significantly less than the range permitted in the description of soil associates. A comparison of presently defined soil series with soil associations, soil associates and phases described in the Carberry Map Sheet Area (Report No. 7) is presented in Table 26.

Table 26. Correlation of the Soil Series Descriptions from the Soil Survey of the Rural Municipality of North Norfolk with the Soil Association Descriptions from the Carberry (1957) Reconnaissance Soil Survey.

Soil Symbol	Soil Series Name	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
ASS	Almasippi	Almasippi, sand	Imperfectly drained, Calcareous Black Meadow associates of the Almasippi Association.
AIZ	Arizona	Stockton, loamy sand	Rapidly drained, eroded knolls in the Stockton Association
ARN	Aronet	Almasippi, sand	Minor wind-blown inclusions of the Almasippi Association. Mainly in fence rows.
BKA	Birkenhead	Agassiz	Excessively drained, calcareous inclusions of the Blackearth associates in the Agassiz Association.
BNF	Blumenfeld	Rathwell	Poorly drained, Calcareous Meadow associates of the Rathwell Association.
BNE	Bone	Holland	Imperfectly drained, very fine sandy loam textured, Degraded Black Meadow associates of the Holland Association.
CXV	Charman	Carroll, Holland	Imperfectly drained, Black Meadow associates of the Carroll and Holland Associations.
DLN	Danlin	Firdale	Imperfectly drained, Degrading Black Meadow associates of the Firdale Association.
DHO	Deadhorse	Rathwell	No equivalent association in Carberry Report. The Closest equivalent in the map area is the heavy textured imperfectly drained, Calcareous Black Meadow associate of the Rathwell Association.
DNH	Denham	Rathwell	Well drained, Blackearth associates of the Rathwell Association.
DOB	Dobbin	Stockton, loamy sands	Well drained, Degrading Black associates of the Stockton Association.
EDK	Edkins	Rathwell	Poorly drained, Meadow associates of the Rathwell Association.
EGF	Eigenhof	Rathwell	Well drained, Blackearth associates of the Rathwell Association.
EEK	Elm Creek	Almasippi, clay substrate	Imperfectly drained, Black Meadow associates of the Almasippi Association with a clay substrate.
ERX	Eroded Slopes Complex	Eroded Slopes	Eroded slope channels along the Manitoba Escarpment.
FND	Fairland	Holland	Well drained, loamy, Blackearth associates of the Holland Association.
FIR	Firdale	Firdale	Well drained, Degraded Black associates of the Firdale Association.
FTE	Fortier	Oakville	Imperfectly drained, dominantly clay textured member on recent alluvium.
GTD	Gateside	Holland	Imperfectly drained, Black Meadow associates of the Holland Association.
GVS	Gervais	Riverdale Association	Imperfectly drained, immature, loamy associates of the Riverdale Association.
GBO	Glenboro	Glenboro	Well drained, Blackearth associates of the Glenboro Association. Also is inclusion of Holland-Stockton Complex in the Carberry Map Sheet.
GDH	Gnadenthal	Rathwell	Imperfectly drained, loamy, Calcareous Black Meadow associate of the Rathwell Association.
GYV	Graysville	Rathwell	Imperfectly drained, Calcareous Black Meadow associates of the Rathwell Association.
GRO	Grover	Glenboro	Imperfectly drained, Black Meadow associates of the Glenboro Association. Also occurs in the Holland-Stockton Complex of the Carberry Map Sheet.
HAT	Halstead	Firdale	Well drained, coarse loamy, Degraded Black associates of the Firdale Association.
HIN	Hibsin	Almasippi, clay substrate	Well drained, Blackearth associates of the Almasippi clay substrate Association.
HMO	Hummerston	Stockton, loamy sands	Imperfectly drained, Calcareous Black Meadow associates of the Stockton Association.
JST	Jasset	Almasippi, loamy sands	Imperfectly drained, Black Meadow associates of the Almasippi Association.
KOT	Kronstal	Almasippi, loamy sands	Imperfectly drained, Black Meadow associates of Almasippi loamy sands Association.
LSL	La Salle	Riverdale Association	Well drained, loamy, immature associates of the Riverdale Association.

Table 26. Correlation of the Soil Series Descriptions from the Soil Survey of the Rural Municipality of North Norfolk with the Soil Association Descriptions from the Carberry (1957) Reconnaissance Soil Survey (Cont'd)

Soil Symbol	Soil Series Name	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
LVH	Lavenham	Stockton	Imperfectly drained, Black Meadow associates of the Stockton Association.
LRY	Leary	Agassiz	Closest equivalent is the rapidly drained, Degraded Black associate of the Agassiz Association.
LLT	Lelant	Almasippi, sand	Poorly drained, Meadow associates of the Almasippi Association.
LOP	Long Plain	Almasippi, sand	Imperfectly drained, immature associates of the Almasippi Association.
MHC	Marsh Complex	Marsh	Very poorly drained, undifferentiated muck and peat soils.
MKY	Mockry	Stockton, loamy sands	Poorly drained, Meadow soils associated with immature soils of the Stockton Association.
NBG	Neuenberg	Almasippi, loamy sands	Imperfectly drained, Calcareous Black Meadow associates of the Almasippi loamy sands Associations.
NUH	Neuhorst	Rathwell	Imperfectly drained, fine loamy, Calcareous Black Meadow associates of the Rathwell Association.
NWN	Newton Siding	Rathwell	Rathwell Association with sandy substrate is closest equivalent in the map area. Imperfectly drained, Calcareous Black Meadow associates of the Rathwell Association.
OBR	Oberon	Wellwood	Imperfectly drained, Black Meadow associates of the Wellwood Association.
ONH	Onahan	Stockton, loamy sands	Imperfectly drained, immature associates of the Stockton Association.
OBO	Osborne	Red River	Poorly drained, Meadow associates of the Red River Association.
OWK	Osterwick	Almasippi, loamy sands	Poorly drained, Meadow associates of the Almasippi loamy sands Association.
PER	Perillo	Marsh and Peaty Meadow	Very poorly drained, organic associates of many associations but dominantly the Stockton and Almasippi Associations.
PTR	Petrel	Glenboro	Imperfectly drained, Black Meadow associates of the Glenboro Association.
PLE	Pleasant	Holland	Imperfectly drained, Calcareous Black Meadow associates of the Holland Association.
PME	Plum Coulee	Rathwell	No equivalent assocation in Carberry report. The closest equivalent in the map area is the heavy textured imperfectly drained Black meadow associate of the Rathwell Association.
POX	Poolex	Holland	Poorly drained, Meadow associates of the Holland Association.
PDA	Prodan	Carroll, Holland	Imperfectly drained, Calcareous Black Meadow associates of the Carroll and Holland Associations.
PSE	Prosser	Holland	Well drained, Blackearth associates of the Holland Association.
RAM	Ramada	Carroll, Holland	Well drained, Blackearth associates of the Carroll and Holland Associations.
RWL	Rathwell	Rathwell	Imperfectly drained, Black Meadow associates of the Rathwell Association.
RIV	Red River	Red River	Imperfectly drained, Black Meadow associates of the Red River Association.
RFD	Reinfeld	Rathwell	Well drained, Blackearth associates of the Rathwell Association.
RLD	Reinland	Almasippi, loamy sands	Imperfectly drained Calcareous Black Meadow associates of Almasippi loamy sands Association.
RGD	Rignold	Rathwell	Imperfectly drained, Black Meadow associates of thei Rathwell Association.
RBK	Rosebank	Almasippi, clay substrate	Imperfectly drained, Calcareous Black Meadow associates of the Almasippi clay substrate Association.

Table 26. Correlation of the Soil Series Descriptions from the Soil Survey of the Rural Municipality of North Norfolk with the Soil Association Descriptions from the Carberry (1957) Reconnaissance Soil Survey (Cont'd)

Soil Symbol	Soil Series Name	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
SUE	St. Claude	Almasippi, loamy sands	Imperfectly drained, Calcareous Black Meadow associates of the Almasippi loamy sands Association.
SCY	Scanterbury	Red River	Imperfectly drained, Black Meadow associates of the Red River Association.
SEE	Sewell	Stockton, loamy sands	Poorly drained, Meadow associates of the Stockton Association.
SEU	Shellmouth Complex	Eroded Slopes	Eroded slopes along the Manitoba Escarpment and stream channels.
SHX	Shilox	Stockton, loamy sands	Rapidly drained, immature associates of the Stockton Association.
SKL	Skelding	Almasippi, sand	Rapidly drained, immature associates of the Almasippi Association.
SQR	Squirrel Creek	Rathwell	Imperfectly drained, Calcareous Black Meadow associates of the Rathwell Association.
SCK	Stockton	Stockton, loamy sand	Well drained, Blackearth associates of the Stockton Assoociation.
TDP	Tadpole	Carroll, Firdale	Poorly drained, fine loamy, Meadow associates of the Carroll or Firdale Association.
TGR	Taggart	Holland	Imperfectly drained, loamy, Calcareous Black Meadow associates of the Holland Association.
TOC	Torcan	Holland	Imperfectly drained, Black Meadow associates of the Holland Association.
VDS	Vordas	Holland	Poorly drained, loamy, Meadow associates of the Holland Association.
WWD	Wellwood	Wellwood	Well drained, Blackearth associate of the Wellwood Association with a fine loamy surface mantle.
WWB	Willowbend	Riverdale Association	Poorly drained, loamy, immature associates of the Riverdale Association.
WWC	Willowcrest	Almasippi, sand	Imperfectly drained, Black Meadow associates of the Almasippi Association.
XVI	Xavier	Marsh and Peaty Meadow	Very poorly drained, deep organic soils.

NORTH NORFOLK: SOIL MAP LEGEND

June 1990

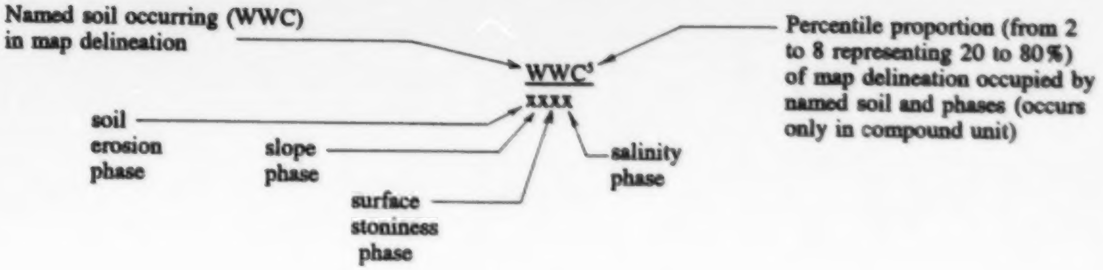
Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
ASS	Almasippi	LFS	IMPER	Lacustrine	Sandy	GLR.BL
AIZ	Arizona	LFS	WELL	Lacustrine	Sandy	O.R
ARN	Aronet	LFS	WELL	Eolian	Sandy	CU.R
BKA	Birkenhead	LS	WELL	Fluviolacustrine	Sandy Skeletal	CA.BL
BNF	Blumenfeld	L	POOR	Lacustrine	Loamy	R.HG
BNE	Bone	VFSL	IMPER	Lacustrine	Coarse Loamy	GL.DG
CXV	Charman	CL	IMPER	Lacustrine	Fine Loamy	GL.BL
DLN	Danlin	CL	IMPER	Lacustrine	Fine Loamy	GL.DG
DHO	Deadhorse	C	IMPER	Lacustrine	Clayey	GLR.BL
DNH	Denham	L	WELL	Lacustrine	Loamy/Clayey	O.BL
DOB	Dobbin	FS	WELL	Lacustrine	Sandy	O.DG
EDK	Edkins	L	POOR	Lacustrine	Loamy/Clayey	R.HG
EGF	Eigenhof	CL	WELL	Lacustrine	Fine Loamy	O.BL
EEK	Elm Creek	FSL	IMPER	Lacustrine	Sandy/Clayey	GL.BL
ERX	Eroded Slope Complex	Var.	WELL-IMP		Variable	CU.R
FND	Fairland	L	WELL	Lacustrine	Loamy	O.BL
FIR	Firdale	SICL	WELL	Lacustrine	Fine Loamy	O.DG
FTE	Fortier	SIC	IMPER	Fluvial	Clayey	GLCU.R
GTD	Gateside	FSL	IMPER	Lacustrine	Coarse Loamy	GL.BL
GVS	Gervais	SICL	IMPER	Fluvial	Loamy	GLCU.R
GBO	Glenboro	L	WELL	Lacustrine	Loamy/Sandy	O.BL
GDH	Gnadenthal	L	IMPER	Lacustrine	Loamy	GLR.BL
GYV	Graysville	L	IMPER	Lacustrine	Loamy/Clayey	GLR.BL
GRO	Grover	L	IMPER	Lacustrine	Loamy/Sandy	GLR.BL
HAT	Halstead	VFSL	WELL	Lacustrine	Coarse Loamy	O.DG
HIN	Hibsin	FSL	WELL	Lacustrine	Coarse Loamy/Clayey	O.BL
HMO	Hummerston	LFS	IMPER	Lacustrine	Sandy	GLR.BL
JST	Jasset	VFSL	IMPER	Lacustrine	Loamy/Sandy	GL.BL
KOT	Kronstal	LVFS	IMPER	Lacustrine	Coarse Loamy	GL.BL
LSL	La Salle	SICL	M.WELL	Fluvial	Loamy	CU.R
LVH	Lavenham	LFS	IMPER	Lacustrine	Sandy	GL.BL
LRY	Leary	LS	WELL	Fluvial	Sandy Skeletal	O.DG
LLT	Lelant	FSL	POOR	Lacustrine	Sandy	R.HG
LOP	Long Plain	LFS	IMPER	Lacustrine	Sandy	GL.R
MHC	Marsh Complex	Peat	V.POOR		Textural Complex	R.G
MKY	Mockry	LFS	POOR	Eolian	Sandy	R.HG
NBG	Neuenberg	VFSL	IMPER	Lacustrine	Loamy/Sandy	GLR.BL
NUH	Neuhorst	CL	IMPER	Lacustrine	Fine Loamy	GLR.BL
NWN	Newton Siding	CL	IMPER	Lacustrine	Fine Loamy/Sandy	GLR.BL
OBR	Oberon	CL	IMPER	Lacustrine	Fine Loamy/Sandy	GL.BL
ONH	Onahan	LS	IMPER	Eolian	Sandy	GL.R
OBO	Osborne	C	POOR	Lacustrine	Clayey	R.HG
OWK	Osterwick	FSL	POOR	Lacustrine	Coarse Loamy	R.HG
PER	Perillo	Peat	V.POOR	Organic/Lacustrine	Organic/Loamy	T.M
PTR	Petrel	L	IMPER	Lacustrine	Loamy/Sandy	GL.BL
PLE	Pleasant	VFSL	IMPER	Lacustrine	Coarse Loamy	GLR.BL
PME	Plum Coulee	C	IMPER	Lacustrine	Clayey	GL.BL
POX	Poolex	FSL	POOR	Lacustrine	Coarse Loamy	R.HG

NORTH NORFOLK: SOIL MAP LEGEND(Cont'd)

June 1990

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
PDA	Prodan	CL	IMPER	Lacustrine	Fine Loamy	GLR.BL
PSE	Prosser	FSL	WELL	Lacustrine	Coarse Loamy	O.BL
RAM	Ramada	CL	WELL	Lacustrine	Fine Loamy	O.BL
RWL	Rathwell	CL	IMPER	Lacustrine	Fine Loamy	GL.BL
RIV	Red River	C	IMPER	Lacustrine	Clayey	GLR.BL
RFD	Reinfeld	L	WELL	Lacustrine	Loamy	O.BL
RLD	Reinland	FSL	IMPER	Lacustrine	Coarse Loamy	GLR.BL
RGD	Rignold	L	IMPER	Lacustrine	Loamy/Clayey	GL.BL
RBK	Rosebank	FSL	IMPER	Lacustrine	Sandy/Clayey	GLR.BL
SUE	St.Claude	SIL	IMPER	Lacustrine	Loamy/Sandy	GLR.BL
SCY	Scanterbury	C	IMPER	Lacustrine	Clayey	GL.BL
SEE	Sewell	LFS	POOR	Lacustrine	Sandy	R.HG
SEU	Shellmouth Complex	FSL	WELL	Fluvial	Coarse Loamy	O.R
SHX	Shilox	FS	WELL	Eolian	Sandy	O.R
SKL	Skelding	FS	WELL	Eolian	Sandy	O.R
SQR	Squirrel Creek	SIL	IMPER	Lacustrine	Loamy/Clayey	GLR.BL
SCK	Stockton	LFS	WELL	Lacustrine	Sandy	O.BL
TDP	Tadpole	CL	POOR	Lacustrine	Fine Loamy	R.HG
TGR	Taggart	SIL	IMPER	Lacustrine	Loamy	GLR.BL
TOC	Torcan	SIL	IMPER	Lacustrine	Loamy	GL.BL
VDS	Vordas	SIL	POOR	Lacustrine	Loamy	R.HG
WWD	Wellwood	CL	WELL	Lacustrine	Fine Loamy/Sandy	O.BL
WWB	Willowbend	L	POOR	Fluvial	Loamy	R.HG
WWC	Willowcrest	LFS	IMPER	Lacustrine	Sandy	GL.BL
XVI	Xavier	Peat	V.POOR	Organic	Mesic Peat	TY.M

MAP SYMBOLOGY


Named soil occurring (WWC) in map delineation
WWC⁵
xxxx
Percentile proportion (from 2 to 8 representing 20 to 80%) of map delineation occupied by named soil and phases (occurs only in compound unit)
soil erosion phase
slope phase
surface stoniness phase
salinity phase

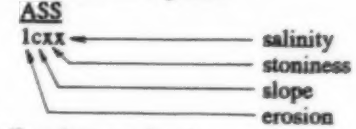
Map Units

Simple Map Units (only one soil named)

Soil Series

LOP

Soil Series with phases


ASS
1cxx
salinity
stoniness
slope
erosion

Compound Map Units (more than one named soil, soil variant or phase)

$$\frac{\text{FIR}^6}{\text{1dxx}} - \frac{\text{TDPp}^4}{\text{xxxs}}$$

Approximately 60% of this example map unit is slightly eroded (1), nonstony (x), nonsaline (x), Firdale soil (FIR), occurring on gently sloping (d) land; and 40% of the map unit is slightly saline (s), Tadpole soil with a thin (15-40 cm) peaty (TDPp) surface layer.

Complex Map Units (undifferentiated complex of soil/landscape features)

ERX

Eroded slopes complex

SEU

Shellmouth Complex

Nonsoil Features

ZZ - water bodies (lagoons, ponds, lakes)
Q - quarries (rock, gravel and sand pits)

Phases

Degree of Erosion

x	noneroded or minimal
1	slightly eroded
2	moderately eroded
3	severely eroded
o	overblown

Slope Class

x	0-2%	level to nearly level
c	2-5%	very gently sloping
d	5-9%	gently sloping
e	9-15%	moderately sloping
f	15-30%	strongly sloping
g	30-45%	very strongly sloping
h	45-70%	extremely sloping

Stoniness

x	nonstony
1	slightly stony
2	moderately stony
3	very stony
4	exceedingly stony
5	excessively stony

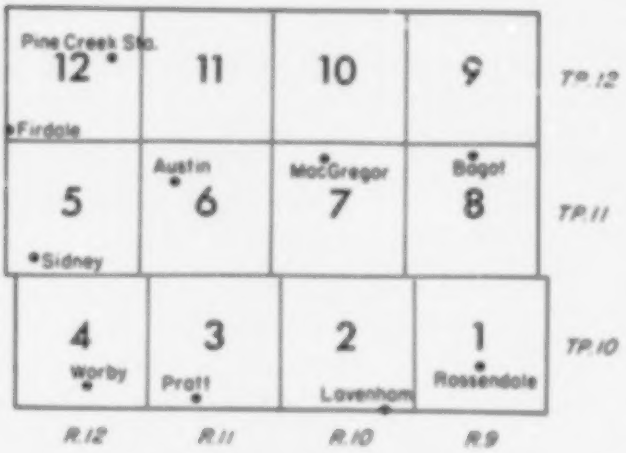
Degree of Salinity

x	nonsaline
s	weakly saline
t	moderately saline
u	strongly saline

Soil Features

p-peaty surface (15 to 40 cm thick)
d-drained soil (artificially improved) drainage

MAP SHEET INDEX


Pine Creek Sta.
12
11
10
9
TP.12
Firdale
Austin
6
MacGregor
7
Bagot
8
5
TP.11
Sidney
4
3
2
1
TP.10
Warby
Pratt
Lavenham
Rossendale
R.12
R.11
R.10
R.9

MAP SHEET INDEX

TOWNSHIP DIAGRAM

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

MAPS
NOT
FILMED

CARTES
OMISES